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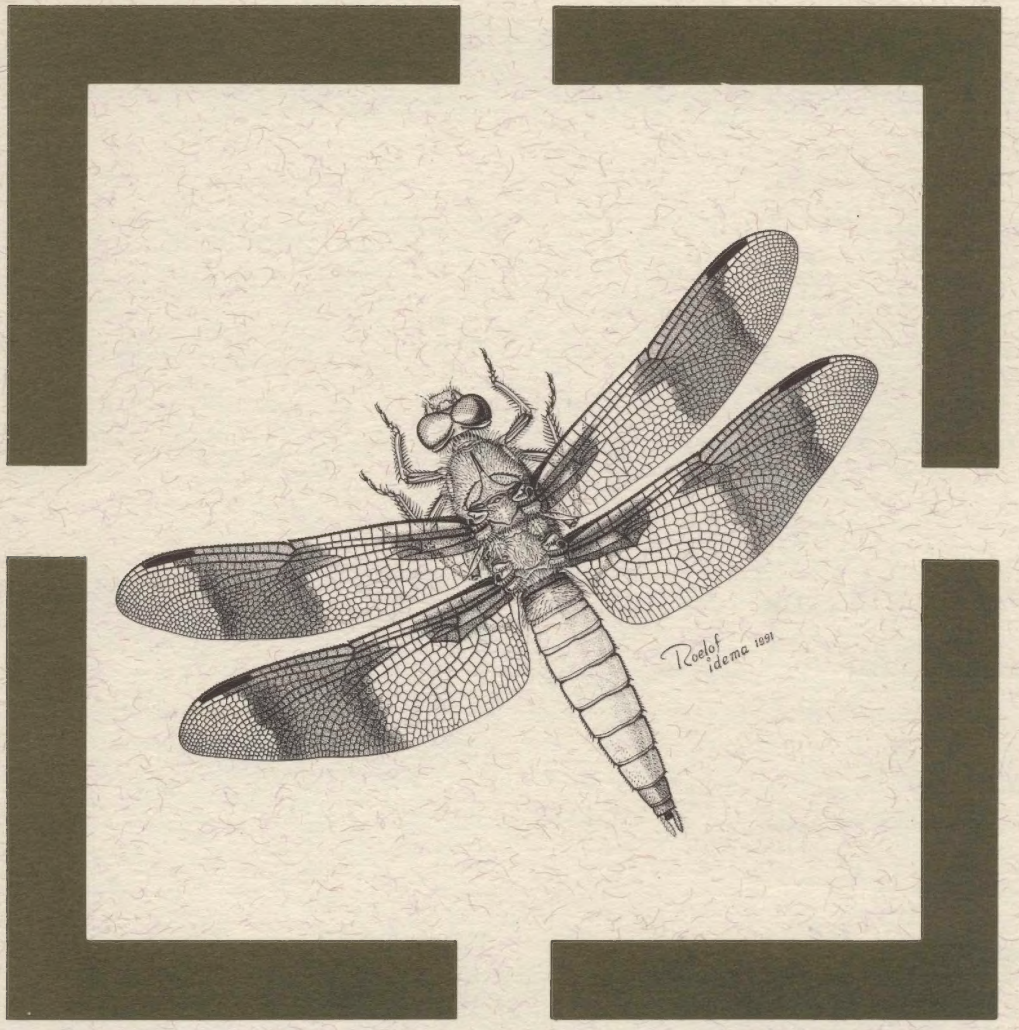

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PAPERS

IUCN and Indigenous Peoples: A new partnership

Statement by the Inuit Circumpolar Conference of the International Union for the Conservation of Nature and Natural Resources (IUCN) - The World Conservation Union, Perth, Australia, November 26 - December 5, 1990.

Presented by Mary Simon, President,
Inuit Circumpolar Conference
650 32nd Avenue, Suite 404
Lachine, Québec H8T 3K4, Canada

In recent years indigenous peoples of the world have taken a strong interest in the activities of worldwide organizations such as the International Union for Conservation of Nature and Natural Resources, including the United Nations Environmental Programme, the United Nations Working Group on Indigenous Peoples, the International Labour Organization, the Convention on International Trade in Endangered Species, and the International Whaling Commission.

At the last General Assembly of IUCN (Costa Rica, February 1988) The Assembly requested the Director General to place a high priority on cooperation with IUCN's NGO members and other NGOs in their efforts to build public support for, and influence governments and international bodies in favour of actions on implementing IUCN's Programme and the goals of the World Conservation Strategy. Moreover, the General Assembly requested the Director General to develop strong cooperative relationships with NGOs of indigenous peoples having traditional knowledge of renewable resource management.

Indigenous peoples are in full agreement with the three basic conservation objectives being pursued by The World Conservation Union, which are:

(a) To secure the conservation of the renewable natural resources of the earth, and particularly its biological diversity, as an essential foundation for human nature;

(b) To ensure that these natural resources are developed and used in a wise and sustainable way;

(c) To guide the development of human communities towards ways of life that are both of good quality and in enduring harmony with nature.

In many instances, indigenous peoples have asked international organizations to recognize and incorporate their extensive traditional knowledge, based on their special relationship with the environment and living resources, in promoting the conservation and wise use of nature and natural resources. We are pleased to note that the Commission on Environmental Law has already taken some decisions that highlight the importance of the rights of indigenous peoples.

As indigenous peoples, we can make a unique contribution to the world in fulfilling the goals and objectives of IUCN. After all, there are over two hundred million indigenous people.

In its report "Our Common Future", the World Commission on Environment and Development discusses the importance of empowering vulnerable groups (p. 114). The report underlines the fact that these communities are the repositories of vast accumulations of traditional knowledge and experience that link humanity with its ancient origins. Moreover, the starting point for a just and humane policy for such groups is the recognition and protection of their traditional rights to land and the other resources that sustain their way of life - rights they may define in terms that do not fit into standard legal systems. This recognition must also give local communities a decisive voice in the decisions about resource use in their area. Hence a more careful and sensitive consideration of their interests is a touchstone of a policy for sustainable development.

In order to ensure that these objectives are fulfilled, indigenous peoples would like to put forward and submit to the attention of this General Assembly a series of concrete initiatives to reflect the New Partnership between IUCN and Indigenous Peoples.

We propose the objectives of IUCN should include:

1. To promote full participation of indigenous peoples in activities of IUCN;

2. To ensure that the traditional knowledge of indigenous peoples is fully integrated in the various environmental initiatives and policies of IUCN;

3. To develop projects and positions on the environmental rights of indigenous peoples as defined in the World Charter of Nature.

ADVOCACY ROLE OF IUCN

No doubt, such a very important international organization as IUCN should play a leading role in supporting indigenous peoples. Here are some elements of this advocacy role that IUCN could undertake:

1. To urge all national and regional governments to take fully into account the views and aspirations of indigenous peoples in relation to development projects;

2. To inform the international community of the environmental concerns of indigenous peoples;

3. To support indigenous peoples in situations where non-indigenous people are competing over a natural resource.

SCIENTIFIC, TECHNICAL AND FINANCIAL ASSISTANCE

As pointed out in the document "Caring for the World - A Strategy for Sustainability", advice and technical assistance should be exchanged among all partners. Partnership can be built around NGOs who work with indigenous peoples (p. 29). In the document, the fourth of eight principles for sustainability reads "Aim for an equitable distribution of the benefits and costs of resource use and environmental management". In this context, achieving eqity means expanding opportunities for the disadvantaged.

To help achieve this, IUCN should:

1. Set up an Inter-Commissional Task Force to deal with issues especially relevant to Indigenous peoples;

2. Provide and earmark funds for assistance to indigenous groups;

3. Provide scientific and technical assistance to these groups.

In closing, I would like to mention to this General Assembly the great importance we attach to the recent regime of having an indigenous Council Member of IUCN, and we believe this should and will continue.

I would also like to reiterate the importance of the objectives we have proposed for IUCN on this new partnership between IUCN and indigenous peoples, and of the concrete and practical suggestions made to ensure the fulfillment of these objectives.

To follow up on this, the indigenous peoples have submitted a resolution to this General Assembly.

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Seaweeds of British Columbia: Biodiversity, ecology, and conservation status

Michael W. Hawkes
Department of Botany
University of British Columbia
Vancouver, British Columbia V6T 2B1, Canada

INTRODUCTION

More than two-thirds of the Earth's surface is aquatic, but, until recently, discussions of biodiversity and conservation have focused on terrestrial rather than marine environments (Hawkes 1990, Eiswerth 1990, Thorne-Miller & Catena 1991). This is due, in part, to the overall much higher species diversity in terrestrial versus aquatic environments. However, one must be cautious when looking at biodiversity solely in terms of species numbers. For example, at the level of phylum, the marine environment is twice as diverse as the terrestrial environment (Carleton Ray 1988). Some marine phyla may not be species rich, but they represent ancient lineages with long evolutionary histories, and in many cases, unique life forms.

Discussions of biodiversity and conservation of terrestrial organisms frequently focus on large, furry animals to the exclusion of many of the more cryptic organisms. In a recent article entitled *Marine biodiversity: The sleeping dragon,* Kaufman (1988) discusses many vertebrate and invertebrate marine animals, but makes no mention of marine plants. This is a surprising omission in view of the fact that, as in terrestrial ecosystems, plants are at the base of the food web. In the oceans 'all flesh is algae'. Furthermore, directly as in kelp, or indirectly as in unicellular zooxanthellae in tropical reef-building corals, marine plants provide habitat essential to the survival of thousands of other species.

THE WEST COAST MARINE ENVIRONMENT

Along British Columbia's 27,000 km coastline, varied oceanographic conditions are encountered, ranging from open ocean with high salinities (32 parts per thousand {PPT}) on the exposed west coast, to more sheltered waters and lower salinities (25 PPT or less) in the inlets, straits and sounds. Along the outer coast, shore stations experience mean sea surface temperatures that vary from a minimum of 3°C in February to a maximum of 14°C in August. Salinity is much lower in protected waters (e.g., Strait of Georgia and mainland inlets) due to a large seasonal input of freshwater from snow melt. Such freshwater input causes a stratification of the water column that results in a stable low salinity surface layer that reaches higher summer temperatures than are encountered on the outer coast. For example, Chrome Island, Strait of Georgia has a monthly mean annual temperature range of 6.6-16.7°C and a salinity range of 24.7 PPT to 28.5 PPT. In some cases, in the immediate vicinity of meltwater runoff, temperatures can be lower than elsewhere on the coast during summer (e.g., Portland Canal).

BIODIVERSITY OF CANADA'S WEST COAST MARINE FLORA

Benthic marine algae, or seaweeds, occur from the high intertidal region down into the subtidal zone to depths of 30 m or more. The Canadian west coast is blessed with one of the richest and most diverse marine plant floras in the world (Fig. 1).

There are three main groups (Divisions in botanical parlance) of seaweed: Red (Rhodophyta), Brown (Phaeophyta), and Green (Chlorophyta). This colour grouping is based on pigment types, but there are also other biochemical and structural features that characterize these three groups. Although these organisms contain chlorophyll, and are therefore photosynthetic, they are not flowering plants and have very cryptic reproductive structures and frequently complicated life histories. In addition, these marine plants lack true leaves, stems, and roots, although they frequently have parts that resemble these land plant structures. Because seaweeds are suspended in an aquatic environment nutrients, and dissolved gases can be absorbed over the entire plant surface. Seaweed form plays a role in, and is probably determined in part by, selection for optimal light interception and nutrient uptake. Some shapes are easier for herbivores to eat than others, so herbivore pressure just as water motion is an additional factor that may influence plant form.

In the subtidal region both light quantity and quality change with depth. The longer wavelengths (red, orange) are filtered out in the first few meters leaving only the shorter wavelenths (blue, green) at depth. Not all wavelengths of light are equally useful for photosynthesis. The chlorophyll pigments absorb violet-blue and red light the most, and green light the least. Marine plants must cope with their changing light environment and many have accessory pigments that enable them to utilize a wider portion of the spectrum (especially green light) for photosynthesis. Kelp are the largest of the Brown seaweeds, reaching up to 25 m or more in some cases. Most are perennial, but some, like bull kelp (*Nereocystis*) are annuals. Giant kelp (*Macrocystis*) can grow 35 cm a day, one of the fastest growing plants. In addition to the kelp, there are many other bladed, saccate, or filamentous brown seaweeds in our flora.

Green seaweed comes in bladed forms (e.g., the common sea lettuce *Ulva* spp.), spongy types (e.g., *Codium* spp.), and many simple to branched filamentous types. It is from the green algal lineage that terrestrial plants evolved.

Red seaweeds are the most numerous in terms of taxonomic diversity, and vary in size from microscopic unicells, to filaments, to 1 m long blades (e.g., *Rhodymenia pertusa*, Fig. 2). Red seaweeds take on many different forms, including hollow sacs (e.g., *Halosaccion*), umbrella-like blades (e.g., *Constantinea*), iridescent fans (e.g., *Fauchea*) and delicately branched blades (e.g., *Delesseria*). There

are also epiphytic and parasitic types of red seaweed. Probably the most unplant-like reds are the calcified crustose and articulated coralline algae. Despite their superficial resemblance to some coral-like animal, they actually are plants with photosynthetic tissue under the deposits of calcium carbonate.

Seagrasses, a fourth and smaller group of marine plants, are whales of the flowering plant world, having evolved in a terrestrial environment then returned to the sea. Marine plants in all four groups are benthic, growing attached to rocks, animals, other plants, or in mud and/or sand, in the case of some seagrasses.

In a recent synopsis of the seaweed flora of the Pacific Northwest (Oregon to southeast Alaska), some 639 taxa (specific and subspecific categories) in 281 genera are documented (Scagel *et al.*, 1989) and most of these occur in British Columbia. Scagel et al. (1989) list the following diversity levels for benthic marine plants in the Pacific Northwest: red algae (Rhodophyta) 373 taxa in 161 genera, brown algae (Phaeophyta) 143 taxa in 66 genera, green algae (Chlorophyta) 117 taxa in 51 genera, and seagrasses (Anthophyta) 6 species in 3 genera. The golden algae (Chrysophyta), a minor group, are represented by 6 taxa in 3 genera. A very approximate estimate would indicate that the floral census is 70-80% complete.

Due to a shortage of systematists and difficulty of access to much of the B.C. coast (both seasonally and geographically), we are still in the pioneering phase of documenting the west coast seaweed flora. This is especially true of the subtidal region. Many species are seasonal, often alternating between macroscopic and microscopic life history stages. There are no areas of the B.C. coast for which we have good seasonal data on the benthic flora.

Field guides to the more common west coast seaweeds include: Abbott & Hollenberg (1976), Dawson & Foster (1982), Kozloff (1983), Scagel (1967), and Waaland (1977). A computer key to common seaweeds in the flora, that uses the VPExpert program has been produced by Widdowson (1989).

Historical Background:

The first seaweed gatherers in British Columbia were the coastal native peoples who collected seaweed for food (e.g., the red seaweed *Porphyra* and the brown kelp *Macrocystis* with herring roe attached [Turner 1975]). Bull kelp (*Nereocystis*) stipe was used for fishing line, the hollow pneumatocyst was used as a storage vessel for oolichan grease, water, and oil. Yew wood bows were bent by steaming them inside the upper portion of stipe (Turner 1979).

The first collections of seaweed, on our coast, made by Europeans are intimately connected with the early voyages of exploration. Archibald Menzies was ship's Surgeon and Naturalist on the Colnett expedition (1787-1788) and the Vancouver expedition (1792-1794). *Egregia menziesii*, the 'feather-boa' kelp, is named in his honour. *Bonnemaisonia nootkana*, a red seaweed, was first collected at Nootka Sound, an important stopping point during these early explorations.

From 1859-1861 David Lyall was medical officer at the British naval base in Esquimalt.

During this time he collected seaweeds at a number of localities on southern Vancouver Island and in the Strait of Georgia.

In 1901, Dr. Josephine Tilden from the University of Minnesota, was instrumental in establishing the Minnesota Seaside Station at Botanical Beach near Port Renfrew (Anonymous 1906, Scott 1974). This was the first marine station established on the Pacific coast in a marvelous area that is still relatively remote.

Our current knowledge of the benthic marine flora of British Columbia is largely due to the efforts of Prof. Robert F. Scagel, *professor emeritus* at the University of British Columbia, and his many graduate students, post-docs, and research associates (Scagel et al. 1989, and Gabriel *et al* 1990).

ECOLOGY

Intertidal zonation, the phenomenon where plants and animals occur in discrete bands at different levels on the shore, results from interaction between physical and biological factors (Fig. 3). The mixed, semi-diurnal tides in British Columbia expose regions of the shore to different frequencies of desiccation, insolation, and freshwater (if it is raining, which it frequently is!). Disturbance, either physical (e.g., storm damage) or biological (e.g., grazing of animals on plants or predation of animals on other animals), also plays an important role in structuring intertidal and subtidal communities as does competition for space. Experimental studies have shown that upper distribution limits are typically determined by physical factors, whereas lower limits are determined by biological factors (Carefoot 1977, Ricketts et al. 1985).

Kelp ecology:

The Canadian west coast is the world centre of diversity for kelp. Giant kelp (*Macrocystis integrifolia*) and bull kelp (*Nereocystis luetkeana*, Fig. 4) form extensive communities, and are major components of the coastal ecosystem, being more productive than tropical rainforests (Leigh et al. 1987). Carbon fixation rates, a measure of productivity, are about 2.5 kg C m^{-2} m^{-1} (2.5 kg per square metre each year).

Biological interactions play an important role in structuring subtidal kelp communities (Connor & Baxter 1989). Of special interest to marine ecologists is the predator/prey relationship among sea otters, sea urchins, and kelp. Until relatively recently, sea otters were abundant along the Pacific coast of North America from California to Alaska. By the early 1900's, the sea otter had been hunted to extinction in British Columbia (although there are unverified reports that some may have survived in isolated pockets, e.g., Calvert Island). With the fur trade effectively removing sea otters from the ecosystem, one of the otter's prey species, herbivorous sea urchins, underwent dramatic population increase with devastating consequences for kelp beds, other fleshy algae, and many associated organisms. The rocky, nearshore ecosystems that we have in British Columbia today are actually highly disturbed systems which should have much higher seaweed biomass and diversity. Evidence supporting this conclusion comes from studies of subtidal habitats before and after sea otter re-introduction.

From 1969-1972, 89 sea otters from the Aleutian Islands in Alaska were re-introduced to Checleset Bay (British Columbia Ecological Reserve #109) on N.W. Vancouver Island.

The population has increased to almost 500 animals and is expanding along the west coast of Vancouver Island. In areas where otters are present sea urchins occur in low numbers and small sizes and the seaweeds flourish (Jane Watson, pers. comm.).

Ecologists speculate that the reduced herbivory caused by otter predation may have been responsible for the evolution of such high kelp diversity in the Pacific Northwest (Estes & Steinberg 1988), a unique situation in the World's oceans.

MARINE PLANT CONSERVATION: ARE THERE RARE OR VULNERABLE SPECIES IN BRITISH COLUMBIA?

Of the 6,691 plant and animal species that have been designated as threatened or endangered world wide, only 16 are marine (and none of these are marine plants). It is likely that such an omission reflects a lack of information or study on the marine plant biota rather than any lack of threat to these important primary producers.

To generate a list of rare or potentially vulnerable marine plant species for the west coast of Canada, I did a search of the benthic marine algal herbarium database at the University of British Columbia. This computerized data base contains 37,374 records which is by far the largest and most valuable collection of B.C. benthic marine algae in the world. As a starting point I chose to limit the search to taxa with 6 records or less as a measure of their rarity or infrequency of collection. Other criteria I used for the selection of taxa as rare include: 1. always small population size and narrow or wide geographic range, and 2. sometimes large population size, but narrow habitat specificity and/or restricted geographic range.

Many of the species with six or less records are small (< 2 cm), poorly known taxonomically, present only seasonally, inhabit the subtidal region, and are often from northern localities (both subtidal regions and northern coasts are incompletely surveyed phycologically). The rarity of such species is probably more apparent than real and much more field data are needed before these species could be recommended for rare or endangered status.

There are several other species, however, that genuinely are rare in British Columbia. For example, the red algae *Arthrocardia silvae, Antithamnion kylinii, Bonnemaisonia geniculata, Hollenbergia nigricans, Thuretellopsis peggiana*, and *Whidbeyella cartilaginea* are known from 6 or fewer localities and typically have extremely small populations (one or a few individuals). The latter species is noteworthy as a local endemic being known from two locations in British Columbia and in the San Juan Islands, Washington State.

The green alga *Codium ritteri* was reported from Botanical Beach, Vancouver Island, around the turn of the century, but has never been rediscovered at that site. Presently it is known from only one site in northern British Columbia (Campania Island).

The kelps *Laminaria farlowii, L. longipes*, and *Dictyoneuropsis reticulata* are reported from less than six localities. *Dictyoneurum californicum* and *Laminaria sinclairii* are close contenders with seven and eight reported sites respectively. Other kelps, while

relatively abundant, have patchy distributions and/or narrow habitat requirements and would be especially vulnerable to harvesting or oil pollution. For example, the Sea Palm kelp (*Postelsia palmaeformis*, Fig. 5), occurs only on extremely exposed sites on the west coast of Vancouver Island. It is absent from comparable sites in the Queen Charlotte Islands and along the mainland coast of northern B.C. *Lessoniopsis littoralis* and *Laminaria ephemera* are other examples.

As far as we know no benthic marine algae have been extirpated from British Columbia waters.

To my knowledge no areas have been set aside to specifically preserve marine algae in British Columbia. This is surprising and unfortunate considering that our kelp forests, both giant kelp (*Macrocystis*) and bull kelp (*Nereocystis*), are amongst the most spectacular and diverse marine communities in the world. This becomes especially urgent now that there is renewed interest in harvesting these kelps commercially. Some of the finest kelp beds in the Province are in Queen Charlotte Strait, between Port McNeill and Port Hardy off the northeast coast of Vancouver Island. A Japanese firm has requested harvesting rights for 10,000 wet tons of *Nereocystis* and *Macrocystis* (50:50) to be used in the manufacture of abalone feed. None of this kelp forest ecosystem has protected status. It is also worth noting that the State of Washington has declared a moratorium on commercial harvesting of kelp. Mumford (1989) states, "the eventual leasing of kelp beds is problematical - their greatest value may be in habitat and food web support." British Columbia collects a royalty of $1/ton of kelp, which adds further support to the argument to leave it where it is!

Instead of using seaweed as bulk fodder another approach, that is being actively pursued, is the investigation of potential biotechnological, pharmaceutical and other specialty uses of seaweed products and processes. Promising species can be tank cultured, leaving wild stands of seaweed to carry out their ecological services as habitat for sealife, birds, sea otters, and nursery grounds for fishes.

Systematists, those most knowledgeable about biodiversity, are themselves endangered species. There are few systematists (working on any group of organisms) currently employed in university or museum environments and even fewer students receiving proper systematic training. In the field of phycology, for example, between Alaska and Mexico, there is only one systematist who is permanently employed. After the ***Exxon Valdez*** spill, one of the most difficult tasks was to locate enough people who knew the diversity of organisms (both plant and animal) to take part in the impact assessment. There is an urgent need to support systematic research and researchers.

Much inventory, systematic, and ecological work remains to be done on the seaweed flora of Canada's west coast. We still do not have a complete species inventory; new species and new records continue to be discovered. Many areas of the coast are poorly collected and we do not have good seasonal information on distribution and abundance for most areas of the coast. Life histories and reproductive biology of many seaweeds, especially the reds, are notoriously complex. We know little about the genetic diversity of seaweed populations in terms of its amount and distribution - essential information for the design of conservation schemes.

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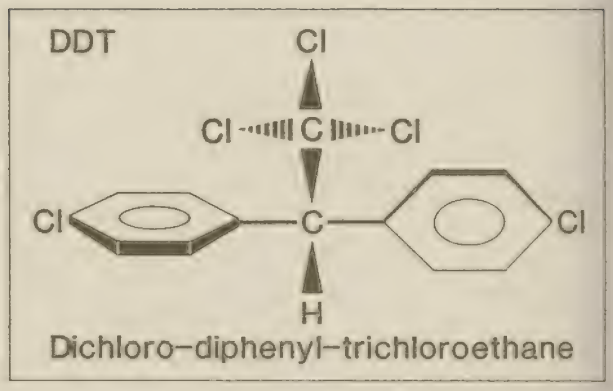
Pesticides and endangered species:
A product labeling program to minimize exposure and risk to protected species



Ralph G. Swanson
U.S. Fish and Wildlife Service
Division of Habitat Conservation
Branch of Federal Activities
1849 C Street, NW
Mail Stop 400 ARLSQ
Washington, DC 20240, U.S.A.

Abstract: A new United States program for the protection of endangered and threatened species from the effects of pesticides is described. The U.S. Environmental Protection Agency will impose use limitations on the application of pesticides that jeopardize such species in conformance with the Federal Insecticide, Fungicide, and Rodenticide Act, and Endangered Species Act. A task force of agency administrators is guiding the development of the program with the assistance of staff-level work groups. Elements of the product labeling program include priority attention to species considered most vulnerable to the effects of pesticides, determination of a threshold effects level of a pesticide, information/regulatory bulletins depicting use limitations, effective public involvement, and the option for state-initiated plans specific to local needs. A voluntary program is scheduled for 1991 to be followed by an enforceable program in 1992.

The U.S. Environmental Protection Agency (EPA) estimates that approximately 1.2 billion pounds of pesticides are sold each year in the United States, about 70% of which is applied in the course of agricultural production (EPA 1986). Evidence exists that pesticides can have a significant impact on some plant and animal populations. Balcomb *et al*, (1984) estimated that 1-2 million bird deaths per year result from the use of the pesticide carbofuran alone. A review of the U.S. Fish and Wildlife Service (USFWS) Endangered Species Information System database in 1988 for 313 endangered and threatened species listed in the United States, included 52 species listed, at least in part, because of herbicide use and 61 species listed, in part, from pesticide use (Halvorson 1988).

The U.S. government is increasingly attentive to the effects of pesticides on fish and wildlife resources, particularly endangered species. Thomas (1989) reviewed the legal requirements and historic practices under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and Endangered Species Act (ESA) of the United States that mandate rigorous testing and evaluation of the effects of pesticides on wildlife. The ESA requires that species of fish, wildlife and plants that are threatened or in danger of extinction be identified, and establishes prohibitions and programs for management and recovery. For example, Section 7 of the ESA requires that no action by a Federal agency may proceed if, in the opinion of the USFWS, it will likely jeopardize the continued existence of a listed species. The USFWS has developed procedures for the review of Federal actions and assessment of their potential effects on listed species.

Under FIFRA, EPA must register (or exempt from registration) any pesticide before it can be marketed or used in the U.S., and may limit the use of any pesticide to prevent unreasonable adverse effects to the environment. Public health and safety warnings, or other environmental cautions, are stated on a label affixed to, or accompanying, the product from the point of manufacture. Once registered, pesticides may

only be legally used in accordance with the label directions. FIFRA also requires the periodic re-registration of pesticides, and label restrictions may be revised when new information warrants. This responsibility to register pesticides under FIFRA falls within the purview of Section 7 of the ESA.

The EPA, with assistance from the USFWS and U.S. Department of Agriculture (USDA), has made significant progress in developing a pesticide labeling program to protect endangered species, with the goal of initiating an enforceable program in 1992. A voluntary program is scheduled to begin in 1991. The Endangered Species Protection Program (ESPP) for pesticide labeling is intended to fill the gap in both information about, and the regulation of, pesticides that may adversely affect the survival, reproduction, and food supply of listed species. Once fully implemented, the program will improve interagency capabilities to review impacts of pesticides, focus government efforts on significant problem areas, and provide meaningful protection to listed species without unnecessarily constraining pesticide users or agricultural production.

In about 25% of situations reviewed to date in which a listed species is affected by the use of a pesticide, the USFWS has concluded that the exposure constitutes jeopardy to the continued existence of that species. In such cases, pesticide use limitations have been developed. Although an outright prohibition on application of a pesticide has been required in some buffer areas around habitats, alternative limitations, such as use of a granular formulation, or application at a reduced rate, have also been adopted.

In a more complex alternative, applicators must conduct field surveys within the range of the red-cockaded woodpecker (*Picoides* (=*Dendrocopos*) *borealis*) prior to using certain pesticides in forests that exhibit minimal woodpecker habitat characteristics. While this places the burden to conduct surveys on prospective applicators, it also provides an objective assessment of impacts prior to pesticide applications, and avoids restrictions altogether when they are not appropriate for protection of the species. The USFWS believes this alternative is preferable to a general prohibition of pesticide use within the entire range of the woodpecker.

To guide development of the program, an interagency task force comprised of top administrators from USFWS, EPA, and USDA is coordinating all important functions of the ESPP with the assistance of staff-level working groups. A Technical Advisory Work Group reviews program options, provides technical information on the effects of pesticides on listed species, and advises on research needs.

The Impacts and Alternatives Work Group examines the economic impacts of use limitations on the agricultural industry and provides technical assistance on alternative pest control methods.
The Outreach and Education Work Group develops public information pamphlets, and assists with publication of an EPA newsletter, *Endangered Species Update*, that highlights issues in the new program.

The basic elements of the proposed program are:

Priority Species Approach: EPA will initially evaluate those pesticides used within the range of endangered or threatened species that the Technical Advisory Work Group has ranked most vulnerable to pesticide toxicity and exposure. This will allow EPA to address immediately pesticides considered to pose the greatest risk to the most susceptible species. In turn, the USFWS will evaluate the effects of these chemicals on listed species pursuant to Section 7 of the ESA.

Threshold Level of Effects: After estimating the expected environmental concentration of a pesticide, EPA will identify the lowest application rate that could affect listed species. Only proposed uses of a chemical exceeding that threshold would be submitted to the USFWS. Proposed uses below the threshold level of effects would not require limitations to protect listed species. Threshold screening should reduce the workload in both the EPA and USFWS and may encourage a trend toward pesticides that are effective at lower application rates.

Product Labels and County Bulletins: Information bulletins that display or describe use limitations will be the primary vehicle to protect listed species from exposure to harmful pesticides. Bulletins will contain a county map showing the affected geographic area and a description of the limitations necessary to protect listed species. The product label will alert users to secure the applicable bulletins which will be freely available and subject to periodic revision as species and product information changes. Use limitations depicted in a bulletin will be fully enforceable under FIFRA. Only about one-third of the approximately 3,100 counties in the United States will have bulletins. (Most counties do not have endangered species that are affected by pesticides.) Because a species may not be exposed to pesticides throughout its entire range, bulletins will not necessarily depict the entire range of a listed species. Thus, bulletins are not range maps for listed species; rather they display the limitations necessary to guide the application of pesticides.

Where a map is not appropriate, due to scale or other considerations, a description of the habitat characteristics that would allow a user to recognize and avoid sensitive habitats may be substituted. Final bulletins may contain a map, a habitat description, or combination of both, along with the necessary use limitations. For particularly sensitive species that could be harmed by revealing location information, alternate methods may be warranted.

Production and distribution of county bulletins will be the most expensive element of the program. Therefore, the USFWS will recommend limitations on pesticides and the preparation of bulletins only for species, and in geographic locations where necessary to effect workable protection. The USFWS will consider alternative protective measures wherever possible to avoid the need for bulletins.

Public Participation: EPA will encourage active involvement by the public, the states, and the agricultural and pesticide industries in all facets of the program. This will include the preparation of county bulletins, evaluation of effects of pesticides on listed species, and the review of use limitations. A series of public meetings in 1988 and the responses to nationwide publication of the ESPP in 1989 have stimulated considerable participation by outside interests.

Options for State-Initiated Plans: In lieu of the Federal EPA program, states will have the option to implement individual plans that are responsive to their agricultural circumstances and the needs of listed species within their borders.

A number of states, including Florida, Hawaii, Iowa, New Mexico, North Dakota, and South Carolina, have declared their intent to develop individual plans to protect listed species. If the USFWS concurs, the EPA would likely accept the state plan in lieu of the Federal program. Some options being considered by the states include individual landowner agreements for species with very restricted ranges (Iowa), multi-agency task forces to evaluate applications for special use permits for pesticide application in sensitive areas (New Mexico), and "species plans" that would implement a separate program of protection for each species (Florida). Most state plans currently in development will rely to some extent

on the county bulletins being developed by EPA.

States and pesticide manufacturers have been urged by EPA to increase direct coordination with the USFWS to improve protections for listed species. For example, section 18 of FIFRA provides conditional exemptions for limited uses of an otherwise unregistered pesticide to combat an emergency pest outbreak. Prior to granting such exemptions, EPA requires the states to present evidence of coordination with USFWS regarding the potential for effects on listed species. States are most often interested in determining whether listed species occur near, and are likely to be affected by, the use of a product in the area of the pest outbreak. Often no listed species occur in a target area. Because time is of the essence in such situations, states are encouraged to adopt the USFWS recommendations so that listed species will not be affected by emergency control activities.

In a separate but related area, manufacturers must secure an Experimental Use Permit (FIFRA section 5) to test the effectiveness of a pesticide, often a newly developed chemical or a new use of a currently registered product. Experiments are usually conducted within small, confined areas (typically 10-40 acres) and for a limited period of time. Such parameters should make it easy to avoid conflicts by selecting experimental sites beyond any known habitats for listed species. EPA will seek a review by the USFWS prior to final processing of the permit application. EPA may condition an experimental use permit based on the technical assistance provided by the USFWS.

The EPA, the states, manufacturers, and individual pesticide users are turning increasingly to the USFWS for assistance in determining whether their proposed uses of pesticides are likely to adversely affect listed species. It is important to understand that the USFWS does not have the authority to approve, restrict or deny the use of any pesticide. That responsibility rests solely with EPA under the authority of FIFRA. USFWS assistance is provided on an advisory basis to assist EPA and others in implementing FIFRA in compliance with the requirements of the Endangered Species Act.

Readers may receive EPA's *Endangered Species Update*, free of charge, by writing the EPA, Endangered Species Protection Program, FOD (H7506C), 401 M Street, SW, Washington, DC 20460.

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Estimating the pharmaceutical values of forests, Canadian and tropical

Don E. McAllister
Canadian Centre for Biodiversity
Canadian Museum of Nature
P.O. Box 3443, Station D
Ottawa, Ontario K1P 6P4
Canada

The world's pharmaceutical industry generates about U.S. $40 billion worth of products. Between a quarter and a half of these are based on wild plants, many from forests.

INTRODUCTION

It is a daunting task to place a non-fibre monetary value on any forest and especially tropical rain forests. Establishing the fibre value - the worth of lumber, veneer, plywood, wood chips and paper pulp, is comparatively simple because the species involved are known and the products have current market values. But the species in tropical rain forests are numerous, many remain to be scientifically described, identification is difficult, their occurrence is poorly known, and many of the non-fibre products they might produce remain to be established. Yet trees do produce pharmaceutical products of immense value or potential value - the anti-malarial quinine from cinchona bark and aspirin originally developed from bark of willows are proven products; taxol from western yew holds great promise in fighting cancer (McAllister and Haber 1991).

This paper develops a simple practical approach to placing values on one class of non-fibre forest products, pharmaceutical or medicinal. The method would apply to other product classes, and some of these uses are listed, e.g., turpentine, rubber, nuts, etc. This paper calculates the proportion of Canadian tree species that produce products of pharmaceutical interest. Canadian tree species are taxonomically well known (there are few if any undescribed species), identification is easier, and their pharmaceutical potential is relatively well known from indigenous, folk and modern medical sources. Applying this proportion or percentage, one can then estimate the number of tree species in a tropical rain forest that are likely to yield pharmaceutical products.

The approach has some shortcomings. The number of pharmaceutical products or potential products available from Canadian trees is incomplete; more will be discovered. Some of the aboriginal and folk remedies may not be effective or may not be as effective as existing products. It is apparent that it would be better to develop this proportion from tropical forests reasonably well-studied for pharmaceuticals. But such a value is not available - that is why we are trying to make this provisional estimate. The northern proportion will, however, provide us with working values, until better data is available from tropical rainforests. And it will provide us with estimates that are needed **now** in economic arguments to preserve as much of the tropical forests as possible in the face of alternative uses of forests or forest lands.

To find whether the ratio of number of species per family was different in boreal than in tropical regions, I calculated ratios from available tree floras after subtracting known exotics. For subtropical Florida the ratio was 2.61 trees (133 species in 51 families), but this is based on quite a small area - that south of Miami. For tropical Soudano-Guinéenne (Africa) the ratio was 4.39 (250 species in 57 families; Aubréville 1950), for seven study areas in Costa Rica 8.05 (837 species in 104 families; Hartshorn and Poveda 1983), for the Golfo Dolce region of Costa Rica 6.01 (433 species in 72 families; Allen 1977), for the South American Guianan fruit-bearing trees 17.44 (1727 species in 99 families; van Roosmalen 1985). The unweighted mean value for the ratios in these four samples is 9.62 species per family. The Golden Guide to North American trees gives a value of 9.61 species per family for tree species north of Mexico, but this value includes some exotic species. For Canada alone the ratio is 5.15 species per family. Nevertheless one can conclude that the ratio in boreal and tropical regions is in the same order of magnitude, that there is quite a bit of variation from country to country, and that the difference between boreal and tropical ratios is unlikely to be a large source of error in these preliminary calculations.

There may be a larger source of error. If one hypothesizes that alkaloids, essential oils, and other exotic chemicals are developed or retained by plants to discourage pests, that a portion of these chemicals are of pharmaceutical potential, and that there are more pests (such as insects) per plant species in the tropics, then one would expect more pharmaceuticals to be present per 1000 tree species. If this chain of argument is correct, then the estimates of numbers of pharmaceuticals derived from Canadian trees will be on the low side.

This paper does not discuss non-monetary values of trees; these are dealt with elsewhere. Mosquin and McAllister (in preparation) discuss the planetary ecosystem functions or services provided by species, including trees, e.g., soil production, flood moderation, nutrient recycling, and photosynthesis. These functions serve all species on the planet, including humans, and enable our survival. Placing a monetary value on most of these functions has not been attempted (see however Pearce 1991 who places a carbon sink value of $3.9 billion per annum on reduced deforestation, based on lowered sea-level rise damage).

The author was called at the last minute to join the Canadian delegation to the UNEP Biodiversity Convention and was not able to polish the text and to update some of the figures, as he had hoped. He begs the reader's forgivingness.

METHODS

There are 134 native tree species in Canada. Data on pharmaceutical and medical uses of Canadian trees were drawn from Lauriault (1989). Data from exotic tree species naturalized or cultivated in Canada were excluded. Pharmaceutical uses were drawn by Lauriault from indigenous, folk and modern medical sources; the source of the use was not always identified. Pharmaceutical uses were not counted when Lauriault indicated probable toxic side effects. Listings of uses for most trees appeared reasonably complete, but for most of those tree species with only a small range in Canada, Lauriault (1991) did not mention pharmaceutical uses. And doubtless other products remain to be discovered. The number of potential pharmaceutical products is therefore conservative.

Some trees contain more than one product or more than one preparation can be made from, say bark; nevertheless I counted each tree species only once.

More difficult to estimate are proportion of the potential of products that will be marketable. Some potential products will not be effective, others will be less effective or more costly than existing products, and some products may not pass required government testing. Of course some of the products are being successfully marketed now, e.g., the laxative cascara and the analgesic acetylsalicylic acid, better known as aspirin, originally from willow bark. Others have had enough use to be known to be effective by indigenous and non-indigenous peoples. Yet other uses are best considered suggestive possibilities with need for proper testing. For working purposes I suggest that 10% of these remedies might become modestly successful or successful market products, or serve local communities. Other investigators are free to modify this and other parameters, if they differ.

Forests provide habitat for other plants and animals that will provide pharmaceutical and other products useful to humankind. An approximation of the number of plants a forest will sustain can be computed from the following figures, if none other is available. There are 134 native tree species in Canada and 3,269 native species of vascular plants (Scoggan 1978-1979). Forests cover half of Canada's land area and the number species is usually proportional to area. Assuming therefore that half of Canada's vascular plant species occur in forests would mean that Canadian forests sustain 11.2 vascular plants per tree species ([1635-134]/134). Rounding this value off, one might assume that forests support about 10 plant species per tree species.

Although gross financial returns on pharmaceuticals and other forest products are reported in the text, it should be appreciated that these require, inter alia, investment by corporations in research, production and marketing, and by states in education and other infrastructures.

RESULTS

Of the 134 native tree species of Canada, 38 or 28% have one or more recorded pharmaceutical or medical uses according to aboriginal, folk or modern medical sources in Lauriault (1989). This value is quite reasonable; Dr. Peter Raven of the Missouri Botanical Garden reports that 20% of China's plants are used in medicines (Gibbons 1990) and Luis J. Povedo, Curator of the Museo Nacional de Costa Rica (pers. comm.) reported that about 1,800 of the approximately 11,000 species of Costa Rican plants, or about 16 %, are known to have medical properties. If the 10% marketability figure, suggested above, is applied then 3.8 species, or 2.8% of Canada's tree biodiversity yield one or more marketable products or have that potential. Examination of Lauriault's book shows that the following species already have one or more marketed pharmaceutical products, or laboratory produced products as extracts or synthetic analogues of naturally occurring tree chemicals: salicylin/acetylsalicylic acid (aspirin), cascara, witch hazel, and McAllister (1991) discusses taxol. Thus our suggested level of marketability is slightly exceeded by the number of revenue-producing pharmaceutical/medical products. This number would probably be significantly enlarged if we included products listed in pharmacopoeia or sold in herbal shops. The 10% marketability prediction is thus met

without resorting to products yet to be developed.

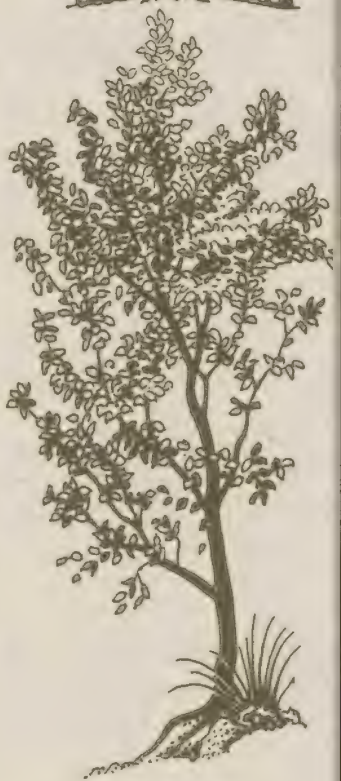
Pharmaceutical/medical tree products encountered in the survey included treatments for: burns, coughs, headaches, toothaches, swelling of hands or feet, dysentery, colds, heart problems, kidney and lung disorders, ulcers, antiseptics, baby powders, vitamin C deficiency, grippe, fever reducers, irritated skin, mosquito bite itch, bee stings, mouth ailments, teeth whitener and cleaner, irritated eyes, wart remover, gargle, pick-me-ups, diuretic, rheumatism, sweaty feet, irritated tonsils, whooping cough, bronchitis, urine retention, circulation problems, bleeding, swelling reduction, diarrhea, sleeping problem, sore throat, poison ivy itching, and others. Thus the 38 tree species provided at least 40 remedies. (I counted remedies only once, though some remedies are found in two or more tree species).

Lauriault (1989) also provides information on research on non-pharmaceutical/ medical and non-fibre wood uses of Canadian tree species. These included the following: dyes; perfumes; tanning compounds; materials for soap, rayon, plastics, photographic film and cellophane; fertilizer; paint; water proofing substances; rope; bird, and squirrel feed; rabbit, beaver, deer and moose forage; food (nuts and seeds); beer; basket- and canoe-making materials; syrup; pottery glazes; heating fuel; food smoking wood; methyl alcohol; ink; fish poison; glue; flavoring and beauty products. This list, scarcely exhaustive, includes 28 non-fibre, non-pharmaceutical products or uses. Assuming 10% of these products are marketable, then this would add another 2.8 marketable non-fibre tree products. Current products/uses exceed this figure and include: rayon, cellophane, wood for smoking food, methyl hydrates, glue, heating fuel and many others not even on the list such as wood bark for gardening, turpentine, etc.

DISCUSSION

Preliminary analyses show that one can expect that more than 3% of Canadian tree species already do produce marketable pharmaceuticals. Current non-pharmaceutical, non-fibre uses of Canadian trees would probably raise this figure well above 5%. If one added future products it is possible that this figure would exceed 10%.

We do not know whether tropical trees would have a greater or lesser number of actual or potential products. If one wishes to take the conservative approach then one could assume that 5% of tropical tree species may be expected to produce marketable products following research and experimentation. This means that for a country that had 1,000 tree species, 50 products might be assumed to be already available or have the potential for development; this would include 30 pharaceuticals.



Some tree-derived or tree-inspired synthetic pharmaceuticals are extremely valuable; 80 million aspirin pills are consumed by Americans each year and about $2 billion a year is spent in the U.S. for non-prescription pain-killers, many of which contain aspirin-like drugs (Weissman 1991). Just to achieve an approximation, let us assume that the average annual value of a tree-based pharmaceutical is $250,000, world-wide. This provisional value is conservative, see discussions below. Actual values of a given drug according to (Oliver-Bever 1986) will depend on:

1) whether it is the only drug, or one of a few drugs, used in treatment of a disease;
2) whether the disease in the treatment of which it is used is a common one;

3) whether it is less toxic than other existing drugs for a given purpose;
4) whether it can be produced more cheaply than alternative drugs used in treating the same disease; as well as the investment made in marketing the drug.

With this provisional annual value of a drug and the percentage of tree species likely to contain marketable pharmaceuticals, one can then estimate the total value of pharmaceuticals that might be available or developed from a forest region. The Philippines for example, have approximately 2,500 native tree species (Merrill 1926), many of them endemic, especially in the uplands. According to our 3% proportion for marketable pharmaceuticals, 75 or more of these species would contain one or more marketable pharmaceuticals. The annual value derivable from these pharmaceuticals would be $18.75 million; adding 2% for the other non-fibre products would bring the total annual value to $31.25 million. This is probably a conservative estimate. Indonesian data suggests that this figure is in the correct order of magnitude; in Indonesia the so-called minor forest products such as gums, resins, nuts and medicines and excluding fuel wood and fibre products, is currently worth at least $150 million a year (Runnalls 1991).

If we assume that the same proportion of non-tree forest plants produce the same ratio of marketable non-fibre products and that the products have the same mean value, then we have only to multiply the estimated tree-based values by ten (or by the locally computed ratio of forest plants to forest trees, if that figure is available). Using this method for the Philippines, where the flora/tree ratio is 3.0, would give the total estimated non-fibre annual value of Philippine forest trees and plants of $91.75 million per year. A single successfully developed drug may represent a significant part of such a figure. The Madagascaran periwinkle, *Catharanthus roseus* (L.), provides the drug of choice, vincristine sulphate, for childhood leukemia, and the secondary drug for Hodgkin's disease and other neoplasms (Farnsworth 1988); U.S. and international sales were reported to total approxately $100 million, 88% of which was profit for the company, Lilly.

These estimates are probably conservative. A recent survey showed that close to 50% of all prescriptions written today contain drugs which are either directly derived from natural sources or synthesized from natural models, as the soul ingredient or as one of the several ingredients (Bricklin 1976). In 1973 over one-and-a-half billion prescriptions were sold in United States drug stores - 1,518,462,000 prescriptions to be precise (Graedon 1980). Sale of prescribed pharmaceuticals in the United States in 1978 exceeded $12 billion, conservatively another $4 billion was spent for hospital drugs, and $5 billion was spent for over-the-counter products, for a total of $21 billion (Graedon 1980). If most of the sales are based on one thousand of the most common drugs, then the average annual American sales of over-the-counter or prescribed pharmaceuticals is in the order of at least $10 million per year; world sales are obviously larger. And averages of today's figures would be yet larger (museum research budgets to locate the figures are relatively small!). This suggests that the mean world sales per pharmaceutical of $250,000 used above is indeed conservative. But it does allow for regionally used pharmaceuticals that would not enter the American market. It must be remembered that these sales are based on investment and an infrastructure of research, production and marketing.

For those pharmaceutical materials which cannot be harvested without harm to the trees, there are three options to ensure sustainability. One is to cultivate seedlings and replant those trees that are harvested. A second option is to splice the genes producing the pharmaceutical into bacteria or other organisms and mass-produce the desired compound(s). The third route is to synthesize the compound(s). With the latter approaches the forest is being treated as a natural gene bank, a bank that is just as important as the nation's financial bank.

The harvesting of fibre and non-fibre products can, in some instances, work hand-in-hand. For example many pharmaceutical compounds are located in the bark and foliage of the tree, where some of them serve to discourage pests. Bark and foliage are often treated as waste; indeed Canadian logging companies often burn this "slash", robbing the soil of needed humus. If logging companies were to investigate the potential uses of bark and foliage of certain forest species, they might earn the name of forest products companies.

Pharmaceuticals and other non-fibre products may offer opportunities for a number of countries whose forests are exhausted or almost so. Those products that can be harvested sustainably with little or no damage to the trees offer a steady income. The forests yielding this steady income will provide, at no additional cost, several ecospheric functions. These functions include: protection against soil erosion, levelling out runoff, flood control, locking up carbon dioxide and moderating the greenhouse effect, habitat for many microorganisms, plants and animals, and others. Such forests can also provide opportunity for recreation of nationals and hard currency from ecotourism.

Related to discussions of conserving biodiversity is compensation for non-scientific sources of knowledge about its uses. Women and men herbalists, imans, indigenous or traditional peoples possess an extensive knowledge of remedies. Western corporations and legal systems are vigorous in defending intellectual rights for their products. Should we not be equally vigorous in protecting the right for compensation for knowledge of these peoples? Will benefits be shared with those peoples providing knowledge of remedies and with those countries possessing the pharmaceutically precious trees and herbs and protecting the necessary ecosystems? For example the pharmaceutical corporation Lilly was making $88 million per year on vincristine sulphate from the Madagascaran periwinkle (Farnsworth 1988). Madagascar was making interest payments of about $97 million per year at this time, reducing money available for forest conservation. If Lilly paid a royalty of 5% to Madagascar, $4.4 million, this would enable Madagascar to help pay interest on its national debt and to increase funding for conservation. An agreement could be drawn up between the company and the country which would assure the company preferential access to its biodiversity, and be satisfactory to both parties. Following writing these lines it was announced that Merck & co. and the Instito Nacional de Biodiversidad of Costa Rica had signed an agreement whereby the Institute would supply Merck with promising material for pharmaceuticals. The Institute will receive in return one million US$. One of Merck's products from a soil microbe found in Spain is used to control high cholesterol. Merck sold $735 million worth of this drug, which is called Mevacor. Underdeveloped countries, frequently caught in a circle of exporting raw materials at low prices and importing manufactured goods at high prices, are attempting to break out of this losing battle in negotiations at

the UNEP Biodiversity Convention. Too often the G7 nations while promoting the philosophy of the market economy, forget about reimbursement of nations, medicine women, and aboriginal peoples from whom they have obtained the plants or medicinal knowledge.

Similar issues exist elsewhere. An agreement signed with the government of British Columbia (B.C., on the west coast of Canada), after lobbying by a pharmaceutical company, allowed the export to the U.S. of 158,000 kilograms of western yew bark (Associated Press, August 1991) for the manufacture of taxol, a drug with considerable anti-cancer potential. An editorial in the Victoria Times-Colonist (August 1, 1991) blamed the B.C. government for not obtaining written guarantees that some of the taxol would be shipped back for treatment of Canadian cancer patients and for not ensuring that the drug was produced in Canada, instead of shipping the raw materials to the U.S. (see also a letter to the editor of the Times-Colonist from Dr. Tom Perry, espousing similar views). In the U.S. the pharmaceutical corporation, the Bristol-Myers-Squibb Company, will pay the Bureau of Land Management an estimated $2-$5 million over five years to count, conserve, research and collect yew bark (Ottawa Citizen, 21 June 1991). A similar agreement was signed by U.S. Agriculture Secretary Edward Madigan with the company for exclusive rights to the bark of an estimated 23 million yew trees on about 3.2 million hectares of national forests in western U.S.

Developing countries may choose between developing their own local biotechnological infrastructures, or signing mutually beneficial agreements with national, international or transnational firms, or some combination of these. For the natural forest investment 'capital' to be maintained, it is essential to conserve forest ecosystem biodiversity. Species-poor tree plantations planted for fibre-based products will not yield the wealth of pharmaceutical and other products found in natural forest ecosystems. Natural regeneration is indicated as the best way to maintain this biodiversity. What tree cutting is allowed in management plans, should be of such sizes and shapes and so adapted to soil types, proximity to stream banks and landscape slopes, that natural regeneration will readily occur and soil erosion is minimized.

To obtain maximum benefit from the forest ecosystems, it is essential to inventory the species capital. Museum field surveys, collections, and research are needed to describe new species, provide classifications, identification books and maps of forest floras. These outputs will serve pharmaceutical and biotechnology companies, as well as those who must work to conserve and manage these forests.

Taxonomic research on relationships of plants to one another, often considered of esoteric scientific interest by the outsider, is of considerable economic interest. Knowing which plants are the closest relatives to a species containing pharmaceutical compounds, will save considerable costs and time in choosing which species should be analyzed and tested for better yields, or which might contain related and more active pharmaceutical compounds. Oliver-Bever (1986) stated:

> *"The botanical relationship of a particular plant to well-known drug plants, or to plants containing therapeutically active constituents, may be an indication of therapeutic interest. Indeed, chemical relationship, based on secondary*

substances specifically found in certain genera and families, has been observed and is made use of in botanical taxonomy. Several genera of one botanical family may thus have a similar action. Many Solanaceae contain alkaloids with a parasympatholytic action, and many Latiatae contain essential oils, while cardiac heterosides are often found among the Asclepiadaceae and Apocynaceae."

This preliminary analysis suggests the following conclusions:

- Natural forests are those that maintain the natural biodiversity of trees, herbaceous plants, etc., unlike species-poor tree plantations.
- Natural forests may contain significant amounts of non-fibre products, including pharmaceutical products, not found in tree plantations.
- Natural forests may provide significant national income and employment.
- To maintain benefits, natural biodiversity must be sustained. Species-poor tree plantations will not provide the same non-fibre benefits as natural forests.
- Billions of dollars are wasted annually world-wide because the value of non -fibre products is ignored. The value of non-fibre products may be significant in relation to the value of fibre-products, or in some cases exceed it.
- The value of tree plantations should be examined in terms of the long-term value of the forests they displace, e.g., plantations of bananas, conifer monocultures, palm oil and coconut plantations.
- Non-fibre products may be harvested or produced sustainably.
- Equitable approaches to sharing the benefits of forest biodiversity need to be developed, so developing countries, and peoples with aboriginal or traditional knowledge about them, receive a reasonable share of the benefits. Such approaches will make conservation worthwhile for all parties.
- Undisturbed forests provide natural gene banks that comprise an important part of a nation's capital.
- Biological surveys and museum taxonomic studies are needed of forest floras to name all the species, produce identification guides and maps to enable effective investigation of pharmaceutical/biotechnological values of forest products, and effective forest conservation and management.
- Taxonomic research on plant relationships is a worthwhile investment as it may reduce costs in seeking plants with higher yields of the compound being sought, or to plants with similar but more therapeutically active constituents.

- While providing non-fibre resources, sustainably managed forests will maintain planetary ecospheric functions.

- The planetary ecospheric functions of natural forests at least equals all other values, for without those functions neither man nor other species would survive.

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VIEWS

In search of common ground

Andrew L. Hamilton
Director, Special Projects
The Rawson Academy of Aquatic Science
1 Nicholas Street, Ottawa, Ontario, Canada

CONTEXT

Fifty years ago ecology was something that a few academics and their students talked about as they sought to define a new science linking living and non-living components of the biosphere. A decade ago few people had heard of the term sustainable development. That began to change in 1987 with the publication of *Our common future*, a report of the World Commission on Environment and Development (WCED 1987), Jim MacNeill, one of the reports authors has recently co-authored a follow-up book entitled *Beyond interdependence* (MacNeill et al 1991). Both documents are really talking about the need to mesh the world's economy with the earth's ecology.

The popularizing of ecology and the use and modification of ecological terms has been an important element in developing a global awareness of the implications of human activities on global life support systems. The public debate and the wide-spread embracing of ecological principles, observations and potential solutions by expert and lay person alike have helped to set the stage for fundamental change. At the same time it is sometimes hard to adjust to the superficiality and opportunism that is a characteristic of some of the "instant" ecologists and environmentalists - that so captivate the media.

Biodiversity was, until very recently, a term used by a few ecologists and systematists - and seemingly of little interest to others. It has now catapulted to the forefront of the global environmental agenda and is no longer simply a term that ecologists once used to quantify and define well-bounded ecosystems. As a global issue it has as much to do with politics and economics as with ecology and systematics. Similarly the global convention that is now being negotiated on the conservation of biodiversity will inevitably raise questions as to the conventions relevance to a variety of other international initiatives. The linkages between biodiversity and the conservation of forest cover are

obvious and direct. International initiatives on climate change and ozone depletion are perhaps less obvious but are likely to also be extremely important. Perhaps of even more importance are the linkages between trade, environment and the conservation of biodiversity. GATT negotiations are clearly critical as are other international and regional economic, monetary and trade agreements. If these international "forcing functions" are not designed to be consistent with "sustainable development" and the conservation of biodiversity then in the long run then there is little hope of slowing the rate of loss of biodiversity.

Biodiversity may be a relatively new term but it matters and it matters a great deal. We are rapidly losing the results of millions of years of evolution and with it the basis for food, fibre, medicines and a host of other human uses. Ecological functions such as pollution abatement, the balancing of the earth's atmosphere and the recycling of soil nutrients are being eroded. There are also compelling ethical and aesthetic reasons for conserving biodiversity. Humans are the overwhelmingly dominant species on earth and many believe that we have an absolute moral responsibility to protect what are our only known living companions in the Universe.

The loss of biodiversity is interwoven with other ominous biospheric trends such as climate change and stratospheric ozone depletion. Trends, which if not slowed, pose a clear threat to long-term human survival on the planet. In essence the conserving of biodiversity is a strategic imperative that over the long-term has a lot to do with survival and sustainability. While this may seem a bit too melodramatic, a lot of responsible voices are coming to similar conclusions.

The Ecological Society of America recently released its report on "The Sustainable Biosphere Initiative" (Lubchenko *et al*, 1991). That report, which is unprecedented in its scope and objectives, concluded that three interlocking concerns: global change, biological diversity and sustainable ecological systems were paramount. The second and third concerns are captured within the meaning of biological diversity as it is now being used. The Science Advisory Board to the United States Environmental Protection Agency also recently released a major report (SAB, 1990) under the title of "Relative Risk; setting priorities and strategies for environmental protection". Global climate change and stratospheric ozone depletion are two of their high risk categories. The other two - habitat alteration and destruction and species extinction and overall loss of biological diversity - are once again key aspects of the biological diversity concern. Fowler and Mooney (1991) paint a particularly ominous picture from the stand point of agriculture. Their recent book, *Food, politics and the loss of genetic diversity*, is a documentation of the rapid loss of domesticated varieties of plants and animals. This loss makes world food supplies (three quarters of which come from nine species of plants) very vulnerable to diseases or changing environmental conditions. We have, as one observer put it, "built our roof with stones from the foundation". The green revolution has favoured the selection of high yielding varieties adapted to today's conditions but it has also accelerated the irretrievable loss of varieties (and genetic material) with characteristics that are less marketable in today's world.

AN INTERNATIONAL CONVENTION

There have now been three intergovernmental negotiating sessions held to negotiate a convention on the conservation of biodiversity. The first two sessions, in Nairobi and Geneva, were held under the auspices of the Ad hoc group of legal and technical experts on Biodiversity. The Madrid session, held June 23 to July 4 in Madrid Spain, was the first session held by the "International Negotiating Committee". Seventy-five countries and fifteen agencies including IUCN, WHO, FAO, UNEP and WWF participated.

I was fortunate to be able to attend the Madrid session as a member of the Canadian delegation representing the Canadian NGO community. I had been preconditioned to expect modest progress and

was aware of previous difficulties that negotiators had encountered but not resolved. The many square brackets in the text of the second draft of the convention provided clear evidence of many of the unresolved questions.

I was pleasantly surprised by the sessions in Madrid and believe that significant progress took place. I was particularly surprised at the positive and constructive atmosphere that prevailed at the session. There was much less acrimony and intransigence than I had expected and, for the most part, this multilateral forum functioned in an orderly and civil manner. After years of working as and environmentalist adviser to the bilateral International Joint Commission (United States and Canada) I found it fascinating to watch the dynamics of multilateral negotiating session.

The Nordic countries were well prepared and played a very active role in trying to seek common ground between developed and developing nations. They had done their homework and clearly had a licence to negotiate towards a meaningful convention for the conservation and sustainable use of biodiversity. Other developed countries including Australia, the Netherlands and Canada also sometimes played the role of peacemaker.

Representatives from some of the smaller developing countries played an important and constructive role. The Bahamas, Guyana and Tanzania were particularly effective in the working group sessions on access to biodiversity and biotechnology and their comments were reasonable, timely and aimed at seeking the common ground. As one might expect the economically powerful countries such as the United States, Germany and Japan generally adopted a cautionary approach while the main spokesperson for the developing countries (usually India, Mexico and Brazil) could be counted on to state their case strongly and (usually) eloquently.

The numerous square brackets in the present text reflect the considerable differences that still separate the respective negotiating positions. One could sense that many of the delegations needed to confer with their respective governments before significant movement could occur. At the same time, talk in the corridors and at the receptions showed that most delegates recognized the potential significance of the task and most wanted to produce a meaningful convention. Also from these conversations it was clear that many participants saw a need for fundamentally changing the way we do business. While it is still too early to tell whether a convention will be ready for signing in time for the World Summit conference in Brazil in 1992 there is reason for optimism and the target, while formidable, may not be beyond reach.

The convention itself may not end up being more than an important global recognition of the need to conserve biodiversity. As the convention now stands it is an uneasy balance between the conservation of and sustainable use of biodiversity. The general objectives and principles that are emerging clearly reflect a recognition of the need to conserve biodiversity.

Some articles in the draft reflect the tension between the developed and developing world over things grouped under the "sustainable use" of biodiversity. Included are items such as access to biodiversity, access to biotechnology and the allocation of costs and benefits of conserving and using biodiversity. In the long run these sections cannot be divorced from GATT negotiations and other international and national policies that now set the ground rules for the global economic system. Eventually, and preferably sooner than later, more effort will have to be directed towards eliminating the incentives and conditions that stand in the way of progress towards a more sustainable future.

THE PROBLEM: A Synopsis of Its Major Facets

The challenge of conserving biological diversity is treated admirably by Soulé (1991) in a recent paper entitled "Conservation: tactics for a constant crisis". He argues that in practice there are about five levels in this biospatial hierarchy of diversity. These are: 1) genes, 2) species, 3) populations, 4) communities and 5) ecosystems. The relationship between the loss of species and the population of humans is illustrated in Figure 1. The percentage loss of the globe's inventory of species has declined very rapidly in recent centuries and the trend is accelerating.

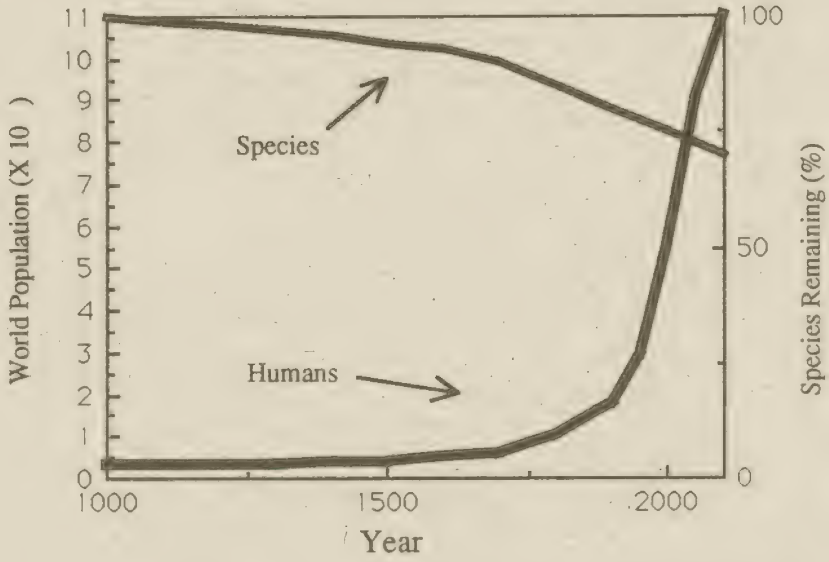

Fig. 1. The expected inverse correlation between human population size and the survival of species worldwide. From Soulé (1991).

Soulé recognized six major classes of human interference that are undermining biodiversity. These are 1) habitat loss, 2) habitat fragmentations, 3) overexploitation, 4) exotic species, 5) pollution, 6) climate change. He used these six classes of interference to estimate the relative significance of each on terrestrial biological diversity in developed (rich) and developing (poor) countries (Figure 2). He suggests that the patterns would be somewhat different for freshwater and marine systems. While I am not familiar enough with marine systems to comment I would think that the overall pattern for freshwater systems would in fact be surprisingly similar to his estimates for terrestrial systems. Once again exotic species would have high impact across the board. For other sources of interference the degree of relative impact would, at least in developed countries, probably be equal to or greater than that for terrestrial systems. The impact of climate change and habitat loss might be moderately less severe in developing countries than in comparable terrestrial systems.

While Soulé's classes of interference may be the most obvious proximal causes the underlying more fundamental causes are, as he outlines, linked to the contemporary human condition - especially as they are linked to the explosive growth in human population. The first of these fundamental causes is population growth, the second poverty which leads directly to hunger, deforestation and trade in rare and endangered species. Misperception reflected in a desire for quick results and a denial of long-term failures is another such cause as is a related cause, anthropocentrism which leads to a lack of support for non-utilitarian needs. Rapid cultural transitions during colonization typically result in unsustainable resource use patterns. The global economics system and the internationalization of markets and erratic pricing of commodities have had a devastating effect on developing countries. The final fundamental

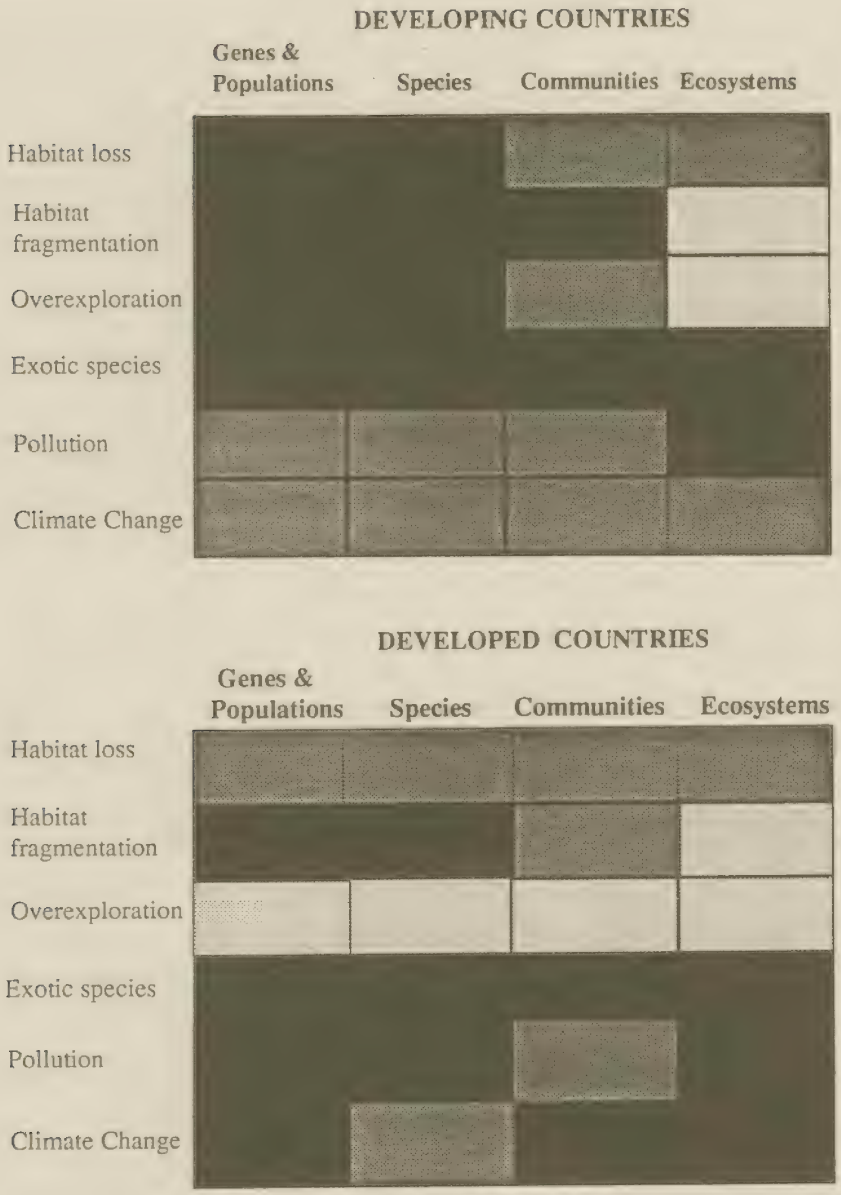

Fig. 2. Relative impacts of factors affecting terrestrial biotic diversity in (A) Developing and (B) Developed countries. Shading indicates intensity of impact: solid = highest; line s= intermediate; gray shading = lowest. Ecosystems refers to landscape level formations including, for example, mangrove habitats, coral reefs, riverine/riparian systems, forests, and savannas. Adapted from Soulé (1991).

cause is the failure to implement conservation policies. Civil disruption, wars and corruption can all be factors in the failure to implement sound conservation policy. Many of these fundamental causes leading to the loss of biodiversity are probably unstoppable, at least in the short and medium term.

There are other factors. The concentration of wealth and power in a few developed countries has led to great differences in resource demands and wealthy countries are, on a per capita basis, a much heavier drain on world resources and world life-support systems than the poorer nations of the world. Indeed

consumption of resources by wealthy countries compiled with global systems of commerce lead to unsustainable demands for products and resources from poorer countries, demands which lead to massive habitat destruction. The globalization of everything from AIDS, to information, to exotic species to trade and markets is rapidly destroying the barriers that led, over millions of years of evolution, to biological diversity. Similarly the cultural diversity that has evolved in association with the landscape and local resources is rapidly eroding. Without a real commitment to some measure of inter-regional and inter-generational equity it is very difficult to envisage a world that can conserve biodiversity or ever achieve a state of sustainable development.

There are many stop-gap things that can be done to slow the loss of biodiversity. These include wilderness parks, zoos, botanical gardens and germplasm banks. It is important to take advantage of what opportunities are available but even the in-situ preservation of wildlands, the most effective means now available, is still only a partial stop-gap measure. Clearly there is a need to address the underlying causes of the loss of biodiversity. Systems, practices and incentives that now undermine biodiversity and other global life support systems must be changed to make them more consistent with sustainable development. This won't be easy!

WHILE THERE MAY STILL BE TIME

The evidence becomes more compelling by the day. Human demands on the resources and life support systems of the earth are clearly not sustainable over the long term and Canada, like other numbers of the worlds family of nations, cannot afford to sit on the sidelines and let present trends continue. Dominant economic and military powers are not likely to take the lead in changing systems that have given them immense competitive advantage over the bulk of mankind. They may follow, but only after it is clear that their competitive positions will not be hurt by moving to more sustainable policies and programs.

Canada along with a few other fortunate countries, such as New Zealand, Australia, the Netherlands, Switzerland and the Nordic countries, are in a unique position to play leadership roles in fundamentally altering our economic systems and production systems to bring them into greater harmony with ecological limits and realities.

Humanity clearly needs champions, including scientific associations, non governmental organizations enlightened national governments and international agencies to take the lead in moving to a more sustainable biosphere. A central task will be to identify and speak to the common long-term interest, and to rise above short-term competitive advantage.

Canada has had a long-term tradition of producing environmental ambassadors that have added knowledge, wisdom and commitment to the shaping of the global environment agenda. Some like Maurice Strong, John MacNeill and Stephen Lewis have operated primarily through United Nations agencies. Scientists like Jim Bruce, Fred Roots, Jack Vallentyne, David Suzuki, David Schindler, Robert Stewart and Stan Rowe have, each in their own way, earned international respect and recognition for their efforts to draw attention to global environmental issues.

Canada's new **International Institute of Sustainable Development** provides an opportunity to build on earlier accomplishments and could provide and excellent forum for the in-depth analysis of ways to harmonize human activities and societies with ecological realities. Countries at every stage of development will need to rethink their long term interests. Canada has a unique opportunity to play a significant role in identifying the common interest, in protecting the long term and in building bridges between the developed and developing world.

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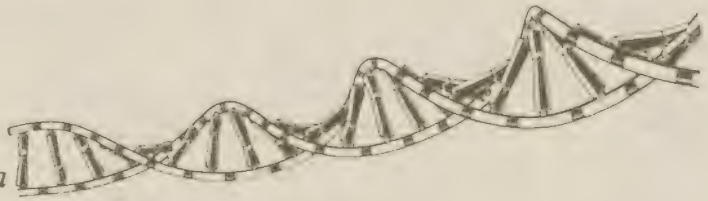
A Canadian Genome Initiative

P.J. McAlpine, Ph.D., F.C.C.M.G.
Department of Human Genetics
University of Manitoba
250 Old Basic Sciences Building
Winnipeg, Manitoba R3E 0W3, Canada

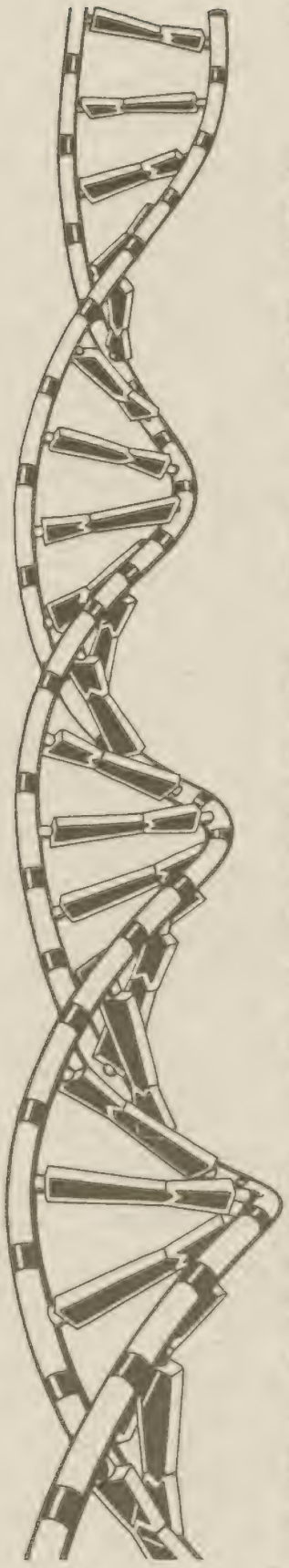


INTRODUCTION

There should be a Canadian Genome Initiative. Mapping and sequencing the human genome is now a possibility. The fulfilment of this exciting promise will have a major impact on i) the diagnosis and treatment of human disease, particularly the common disorders which affect the largest numbers of population, on ii) the understanding of normal and "deviant" behaviors which will require new perspectives (and programs) for dealing with social issues, on iii) a new understanding of the human condition. These understandings may be at levels of complexity beyond those which we can only contemplate as existing today.

While the new paradigm described in the Scriver report is a product of the 20th Century, its impact will not likely be completely understood during the 21st Century.

The remarks which I will make will have to be considered as personal views: as I did not receive my invitation to this meeting until January 2nd [the Inter-Council Human Genome Advisory Committee meeting held in Ottawa, 8 January 1991], I have not had an opportunity for extensive consultation prior to this meeting.



SOURCES OF FUNDING

There should be a Canadian Genome Project and it should be funded by new monies rather than a redistribution of the already limited resources for existing programs. The redistribution of resources from existing programs would precipitate a crisis in other areas of biological research. Potential sources of funds are the Federal Government, non-profit organizations and industry. As the Human Genome Project will have significant potential spin offs to the industrial sector, including increasing the amount of national "high tech" industry, it would be appropriate for industry to contribute R and D to the Human Genome Projects.

WHAT SHOULD BE FUNDED

As the Human Genome Project is unlike any other scientific endeavor undertaken to date, it involves activities which do not fall under the guidelines for the funding of existing programs. Some of these activities include:

1) International meetings

Until September of last year when MRC (Medical Research Council) provided travel funds for the five Canadians who chair committees of the Human Gene Mapping Workshops, non-Canadian funds were used exclusively to support the participation of Canadians as committee chairs at these workshops. As the cost of these meetings is now very high (so high that the future of the large biannual meetings may be in doubt) financial assistance from the countries of origin of the committee chairs is required. If Canadians are to continue to be recognized internationally and invited to be Commitee Chairs at these meetings which have global responsibilities to produce definitive versions of the human gene map at regular intervals, we have to be prepared to pay our own way - we cannot expect to be considered as "honorary Americans" for the purposes of funding. As the request for travel and acommondation of the Canadian committee chairs for HGM11 did not receive a favourable response, the future involvement of Canadians at these meetings is in doubt. Unless Canadians participate in the Human Gene Mapping Workshops, Canada will not be part of the global gene mapping endeavour, regardless of the programs in place or introduced.

Recently, again under the initiative of the Americans, chromosome specific workshops are being convened to consider mapping data and approaches in detail - an objective which cannot be achieved at the HGMW's unless they are extended in time. Because there is no apparent mechanism in Canada to fund these workshops, Canadians organizing such meetings have to have an American "surrogate" to secure funding from U.S. sources. Consequently, the credit for the scientific leadership provided by Canadians at these meetings does not accrue to them - it accrues to the Americans.

These two examples illustrate the necessity for Canadians to have the opportunities to participate fully in the Genome Project, if Canadian science and scientists are to retain international credibility. As the Genome Project has a high international profile, considerable prestige could accrue to Canadian agencies, if they were to support the initiative.

The second issue addressed under what should be funded is communal resources/ facilities. The provision of regionalized or centralized resources would facilitate research already in progress, as well as new initiatives. Such resources/facilities should extend existing Canadian strengths and could include:

1) tissue specific cDNA (complementary DNA) libraries.
2) chromosome specific YAC (yeast artificial chromosome) production (continental vs. global approach).
3) interspecific somatic cell hybrids and in situ hybridization for confirming chromosomal origin of cloned sequences.
4) oligonucleotide production.
5) software sharing, including tayloring of existing program packages to local conditions. (The British have found software for local manipulation of sequence data not readily available nationally).
6) sequencing capabilities (important for STS's (sequencing tagging sites) - the new version of D numbered loci).

In addition to the Canadian strengths listed above, Canada has a unique resource in its special families which are accessible (at least compared to the U.S.A.). Furthermore in Canada, we also have recognized expertise in addressing ethical concerns. However, the major deficiency - communication between scientists - must be improved. Newsletters and workshops are two possible formats to facilitate the sharing of information, techniques, resources, etc.

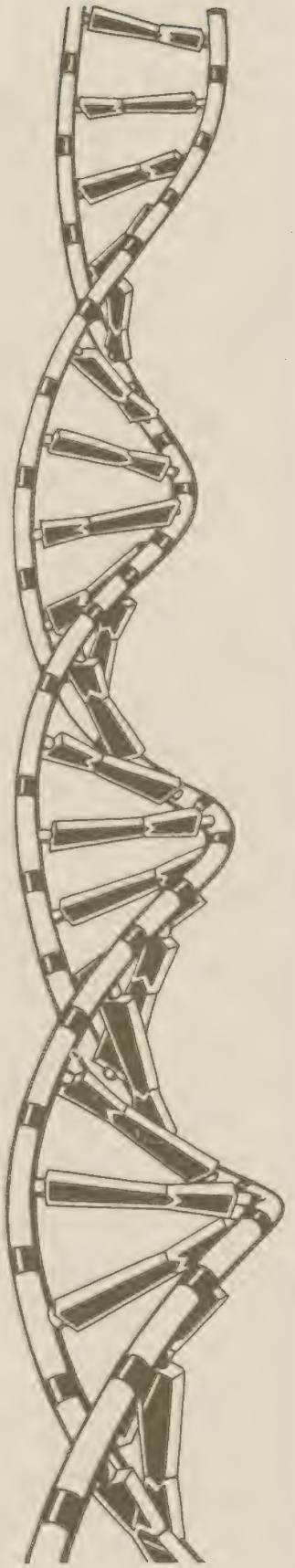
DISTRIBUTION OF FUNDS

Funding for laboratory based research should be available through investigator-initiated proposals. All Canadian scientists should be eligible to apply for funding, regardless of whether they are members of a large group - the right to compete for funding should not be restricted to self selected groups. Proposals for funding should be subject to peer review and it is hoped that the Canadian scientists who are internationally recognized for their human genome mapping research will not be excluded from actively participating in the process of peer review or from establishing policies regarding a Canadian Genome Project.

Proposals for genomics activities should be reviewed by a new and separate grant review committee, possibly following NSERC strategic grant program for targeted research Genomics. These proposals should not be competing side by side with experimentally based proposals. Thse are distinct differences between chromosomal based approaches to mapping and, for example, structure-function relationships of mutant disease determining genes.

CONCLUDING COMMENTS

Limited funding should be devoted to sequencing at this point in time, except for technology development. Serious mapping of the human genome is unlikely until the tehcnological capability of sequencing DNA without cloning is achieved. Research into the development of such instrumentation is already in progress, at least in the U.S.A.; this is an area that Canadian industry may wish to address.



Finally, Canada should be prepared to support the future with funds for postdoctoral training and the present by supporting HUGO, the international organization concerned with human genome research.

NOTE: Our next issue will have a more detailed article on the human genome: The Genome Project: Mapping and sequencing our genes

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Biodiversity studies and forest management in British Columbia

Modified from an article originally published in "Queen Charlotte Islands Observer", Nov. 19, 1990.

T.E. Reimchen
Box 970
Queen Charlotte City, B.C. V0T 1S0, Canada

Government agencies in Canada have recently begun an investigation into the issue of forestry practices and biological diversity in coastal British Columbia. The growing awareness of species loss in the tropics from deforestation necessarily directs attention to our own land use. Dale Seip and Jean-Pierre Savard (1990) have combined their talents to provide us with answers to the question of whether clearcut logging of old-growth forests has any longterm effects on biodiversity in British Columbia. Clearly, if this were the case, there might have to be even further withdrawals from the annual allowable cut of old-growth. However, if there were no reduction in diversity, the extensive history and continued practice of clearcutting should be of little concern to the public, at least with respect to biodiversity.

In a progress report on their research, Seip and Savard (1990) stated "In order to maintain and enhance biotic diversity, it is crucial to understand the needs of wildlife species in terms of habitat so that we can preserve and/or manage habitat required to maintain viable populations". As such, the authors looked at abundance of small mammals and birds in old-growth, second-growth and clearcut habitats. They censused number of species and abundance of individuals in two or three different areas for each habitat type. Results showed that mice and shrews were most abundant in clearcuts and they conclude that "all of the small mammal species present on the Queen Charlotte Islands can survive in managed forests, if snags are maintained in adequate number". They also found that "Some bird species were most abundant in old-growth and second-growth and some species were most abundant in clearcuts". No species were restricted to old-growth other than possibly Brown Creepers and Marbled Murrelets.

If these results are representative, that is, mammals and birds are equally diverse in old-growth, second-growth and clearcut forests, then the persistent hand-waving of environmentalists is without substance. Forestry policies do not require some fundamental overhaul as frequently argued by its opponents. The implications of the Seip/Savard study are that large areas of old-growth are not required for the maintenance of biological diversity. In fact, the authors state that even more second growth may be required. Their argument is that since second growth occasionally supports lower population densities than old growth, the amount of second growth will have to be increased to bring numbers up.

Two concerns come to mind over this investigation. The first and most obvious is that there are thousands of species in old-growth forests including unicellular organisms, fungi, mosses, liverworts, flowering plants, soil, ground and canopy insects and other invertebrates to name but a few that are a component of the biodiversity, yet in this study, it is several species of small mammals and birds that are used to evaluate the large question of whether biodiversity is effected by deforestation. Presumably one has to start somewhere, but it is not completely clear why the investigators limited themselves to looking at two groups that were highly mobile and widely distributed. In the tropics, and presumably here as well, it is the species with restricted distributions that are the first to disappear during deforestation and these should be the focus of any meaningful study of biodiversity.

The second concern is the issue of species tolerances. Over the last 100 years, various researchers have investigated causes for differences in distribution and abundance of species. These studies have been carried out in many areas including tundra, deserts, tropical rainforests and coral reefs. Not unexpectedly, such studies show that numbers increase during periods of plenty and decrease during periods of scarcity. Species distributions tend to expand, even into poorer habitats, during periods of climatic optima but shrink during periods of environmental extremes, such as during prolonged periods of drought or rain. It follows that the longterm persistence of a species in a geographical area will largely depend, not on the amount of habitat during optimal conditions, but rather on the availability of suitable habitat during extreme conditions.

What are the implications of this to the Seip/Savard study? Remarkably, this study looked at the abundance and diversity of species only during summer, when climate was most benign, when food was most abundant and when conditions were optimal for reproduction. That Seip and Savard found that many bird species at this time used second-growth and clearcuts is irrelevant to the issue of biodiversity. Virtually anyone who has wandered through a clearcut during extended periods of frost, rains, snowfall or during strong winds soon observes that virtually all birds are found in adjacent old-growth. This is obvious because the canopy of the old-growth produces a buffer to the extremes in temperature, rain and wind while the forest floor provides a complex of potential prey taxa. Because we can be found on our patios during a calm summer evening does not imply that patios provide sufficient habitat for the human species in winter.

Minimal requirements for this investigation would have been the quantification of the floral and faunal diversity in different stages of second-growth during winter or other climatic extremes. In its present design, which does not meet these minimal criteria, the Seip/Savard study is virtually without any scientific value for addressing the larger issue of biodiversity, the primary focus of the investigation. This is quite apparent because at its completion, we will not know whether mature second-growth has attained 5% or 95% of the original taxonomic diversity observed in old-growth forests. Yet these flawed studies are used to formulate and justify forestry policy throughout the province. Society deserves more rigorous research programs than this if we wish to understand the impacts of large-scale deforestation.

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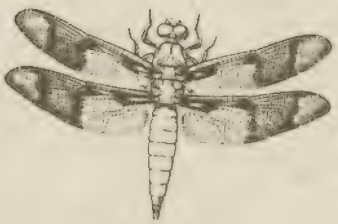
Insects are worth saving

IUCN Resolution on conservation of insects and other invertebrates

The following resolution was passed at the IUCN general meeting at Perth, Australia:

RECOGNIZING that there are over one million identified insects and other macro-invertebrates, constituting at least three-quarters of the world's known species and that millions more unidentified species are believed to inhabit poorly studied environments;



ACKNOWLEDGING that insects and other invertebrates, by virtue of their long evolution, variety and adaptability, have colonized virtually all ecosystems on earth;

APPRECIATING that insects and other invertebrates have far-reaching and economically important roles in the proper functioning of natural ecosystems;

ALSO APPRECIATING that insects and other invertebrates are of enormous cultural, educational and aesthetic benefit to mankind;

RECALLING that surveys of insects and other invertebrates can be of great value in the identification of key areas for the conservation of global biodiversity, in indicating environmental quality, and in monitoring ecosystem disturbance, pollution and change;

COMMENDING the Council of Europe's farsightedness in publishing the "Charter of Invertebrates" and the wisdom of the Committee of Ministers of Member States in adopting Recommendation No R(86)10 calling for governments to take account of the Charter when drawing up their management policies;

RECALLING that insects and other invertebrates are, amongst other wildlife, the subjects of international conventions, including the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Conservation of Migratory Species of Wild Animals (Bonn) and the Convention on European Wildlife and Natural Habitats (Bern), and that many nations have legally protected threatened insects and other invertebrates;

CONCERNED that the main threat to insects and other invertebrates is destruction and degradation of natural habitats, although the habitat requirements of nearly all invertebrates are poorly understood;

CONSCIOUS that many insects and other invertebrates, particulary those endemic species inhabiting island ecosystems, have been brought to extinction through the accidental or purposeful introduction of alien species, and recalling IUCN Recommendation 17.51 "Introductions of carnivorous snails for biological control purposes" and the IUCN Position Statement on "Translocation of living organisms" in this regard;

BELIEVING that collecting of insects and other invertebrates for science, education and curiosity is rarely damaging to their populations, but that commercial collecting for food or trade needs to be controlled at a sustainable level;

AFFIRMING that habitat conservation is the most necessary conservation measure for invertebrates but welcoming additionally the activities of zoo and butterfly houses in support of invertebrate conservation, particularly the formation by the National Federation of Zoological Gardens of Great Britain and Ireland of an Invertebrate Working Group and by the American Association of Zoological Parks of an Invertebrate Management Advisory Group;

AWARE that many nations have recorded the decline of their invertebrate faunas in Red Data Books, and that IUCN has published Red Data Books on invertebrates and Swallowtail butterflies;

The General Assembly of IUCN, at its 18th Session in Perth, Australia, 28 November-5 December 1990:

1. WELCOMES the establishment by the IUCN Species Survival Commission of an Invertebrate Task Force drawn from the IUCN/SSC Invertebrate Specialist Groups and charged with developing and promoting a strategy for IUCN activities to conserve insects and other invertebrates, and urges the IUCN Secretariat and IUCN members to provide support for the Task Force, and to make every effort to assist in the identification and execution of priority activities;

2. REQUESTS the Director General, within available resources, to strengthen support for the IUCN/SSC Specialist Groups concerned with invertebrates;

3. CALLS UPON IUCN members to assist in the implementation of published and forthcoming Action Plans for Swallowtail butterflies, Molluscs and other invertebrate groups;

4. URGES governments to:

a. draft their national protective legislation recognizing that the primary threat to insects and other invertebrates is habitat destruction;

b. broaden the scope and content of existing international conventions to make them more appropriate for insects, other invertebrates, and particularly their

habitats; and

c. promote practical recovery plans for invertebrate species already listed in national legislation and international conventions;

5. ALSO URGES governments, government agencies and nongovernmental organizations as appropriate to:

a. promote programmes of integrated and multidisciplinary scientific research aimed at better understanding of the ecology of insects, other invertebrates and their habitats;

b. adopt and/or provide rejuvenated programmes of biosystematics and taxonomy of insects and other invertebrates and more effective collaboration between taxonomic institutions, and more focus of these activities on conservation planning;

c. recognize conservation science as an essential activity for the effective maintenance of the diversity of insects and other invertebrates;

d. record selected invertebrate groups while assessing the natural conservation value of areas, especially if the assessment is aimed at choosing areas for protection;

e. limit use of biocides, especially in agriculture and forestry, to the minimum and take all possible measures to reduce the impact of biocides on non-target species;

f. avoid accidental introductions of exotic species, and while recognizing that introductions of species for biological control may have advantages for the environment over other forms of pest control, to permit such only after public environmental impact assessments have been carried out;

g. develop and support environmental education programmes that foster appreciation of insects and other invertebrates, as well as the value of preserving biodiversity in general;

h. strengthen invertebrate displays by zoos and butterfly houses linked to captive breeding and re-establishment programmes, and the development of codes of practice on the welfare and management of invertebrates in captivity;

i. accept trade in invertebrates where this is shown to be based on sustainable practices that are not permanently damaging to wild populations, and where there are benefits in terms of scientific knowledge, public education, continuity of natural habitats, or rural development.

SOURCE: 1991. CBSG News, Vol. 2 (2): 17-19.

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NEWS
Biodiversity News Notes

Biodiversity hearings in U.S. House of Representatives

The legislation to establish a national policy on biodiversity and a National Center for

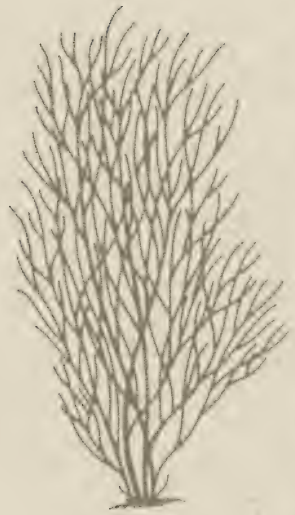
Biodiversity has re-emerged in the 1991 Congress of the United States in two versions. On May 23rd the House Science Committee's Subcommittee on Environment held hearings on HR 585, the bill equivalent to that passed out of the Committee last year. Peter Raven testified for the Association of Systematics Collections (ASC), while Secretary Adam and Thomas Lovejoy testified for the Smithsonian Institution (whose National Museum of Natural History is the American counterpart of the Canadian Museum of Nature). Dr. Raven and Dr. Lovejoy also participated in a press briefing before the testimony. HR 585 was introduced by Congressman Scheuer of New York, who has worked tirelessly on this issue. ASC presented Congressman Scheuer with a citation for his work on biodiversity legislation at its Annual Meeting last year.

Dr. Raven testified in favor of HR 585, and spoke strongly for the concept of the Center for Biodiversity and its roles in developing information on biodiversity through consolidation of existing information in relational databases and contracting research once priorities are set. Dr. Raven emphasized the national need for a biological survey, and said the best place was within the Smithsonian Insitution with an independent board to set priorities. Secretary Adams testified that the Board of Regents had not yet met to finalize the Smithsonians's position towards such a Center, but the idea was very compatible with the Smithsonian's mission and a highly desirable role for the Smithsonian; it was being positively received. He mentioned ASC's involvement in planning the Center for the Smithsonian. Dr. Lovejoy reinforced the need for the Center as a body independent of the mission-oriented (or regulatory) federal agencies, and illustrated the Smithsonian's long role in biological survey by showing one of the Exploring Expedition's volumes from the 1850's.

The day before the Environment Subcommittee met, the House Merchant Marine Committee's Subcommittee on Fisheries and Wildlife Conservation and the Environment held hearings on HR 2082, a version of the biodiversity legislation introduced by Congressman Studds of Massachusetts and also supported by Scheuer. The Studds version lacks some of the detail and interactive elements of HR 585, and does not place the Center for Biodiversity in the Smithsonian, as HR 585 does. Instead it leaves the positioning of the Center unsettled, but ASC's information is that there is a move to place it within the Fish and Wildlife Service, over which the committee has legislative jurisdicion. HR 2082 also contains authorization to fund the Nature Conservancy's database development and the Heritage Programs. ASC has supported the latter, through funding of the state entities responsible for the Heritage Programs.

ASC arranged for Andrew Knoll of Harvard University's Botany Museum to testify on behalf of AIBS and ASC at the Merchant Marine hearing. Frank Talbot (Director of the National Museum of Natural History) joined Secretary Adams in speaking for the Smithsonian. Talbot spoke clearly of the desire of the Smithsonian to house the Center for Biodiversity, and of the importance of studying biodiversity of fishes and other taxa that receive relatively little attention.

One possible outcome is that the bill finally reported out of the two committees will include elements of HR 585 and HR 2082. The Senate hearings on S 58, virtually the same bill as HR 585, are expected in June by Senator's Baucus' Environment and Public Works Committee. The bill was introduced by Sen. Moynihan of New York. Senate



staffers say that they are eager to move the legislation, but warn that there is less environmental awareness in the Senate than in the House. Education of Senators serving on the Environment Committee and the membership at large will be necessary for the legislation to achieve success. [ASC Newsletter 19(3): 34, June 1991].

North American Biodiversity Strategy and Action Plan at Keystone Center

Over one hundred Canadians, Americans and Mexicans met July 14-17, 1991 at the Keystone Center in the Colorado Rocky Mountains to discuss strategies to conserve and utilize North America's biological diversity. The meeting involved individuals from diverse interests and organizations concerned with preserving and utilizing biodiversity such as: federal, state and provincial environmental and land management agencies; the private sector (e.g., forest products companies, oil, gas and mining companies, ranchers, farmers, fishing industry); native American organizations; environmental organizations; and zoo, seed bank, botanic gardens and aquaria directors.

The "North American Consultation" was convened by The Keystone Center, a neutral conflict mediation organization headquartered in Colorado. This unique meeting was jointly requested by the World Resources Institute (WRI), United Nations Environment Programme (UNEP), and the International Union for the Conservation of Nature and Natural Resources (IUCN) which are collaboratively developing a world Biodiversity Strategy and Action Plan to be presented for consideration at the 1992 U.N. Conference on Environment and Development (UNCED) in Brazil. The UNCED is the 20th anniversary of the United Nation's first conference on environment held in Stockholm in 1972. Heads of State from around the world will convene in Rio de Janeiro in June 1992 to review and consider treaties and other international policy options to address issues such as: global climate change, biological diversity, ozone depletion, toxics and water pollution.

The three international organizations developing the global Biodiversity Strategy and Action Plan are now in the process of meeting with leading individuals and organizations in various regions of the world to review a draft of the Strategy and Action Plan before it is finalized. The North American Consultation was one of seven being conducted. The other consultations are being convened in locations around the world, including: India (Asia), Indonesia (Southeast Asia/Oceania), United Kingdom (Europe), Brazil (South America), Costa Rica (Central America), and Kenya (Africa). The world Biodioversity Strategy and Action Plan calls for a "Decade of Biodiversity" to raise public awareness about the loss of diversity of animal and plant life at the genetic, species and ecosystem levels. It outlines institutional, educational and local activities and changes that need to occur to stem biodiversity loss, and to develop more sustainable uses of biodiversity to meet human needs. WRI, IUCN and UNEP are pursuing the regional consultations to gather local input on the feasibility and appropriateness of the document to address this critical global issue within differing economic and cultural situations.

The North American Consultation was intended to solicit reactions to the draft document from individuals from a cross section of interests and to initiate discussions about biodiversity in North America. The diverse group that came together in Colorado spent considerable time developing an assessment of issues requiring attention in North America. There were several areas that received consistent attention and discussion

including: the need for an inventory of biodiversity in North America; increased participation by the private sector in biodiversity activities; greater communication and cooperation between state/provincial and federal governments with local areas; acknowledgement of the role of native peoples and cultural diversity in biodiversity conservation efforts; increased public awareness of biodiversity; more active involvement of local communities in the study and conservation of their local natural areas; the exploration of bilateral and trilateral efforts to manage bioregions in North America; and the need to expand the notion of national and international security to include ecological sustainability.

For more information about the North American Consultation please contact: Connie Lewis or Michael Lesnick at the Keystone Center, P.O. Box 606, Keystone, Colorado, USA 80435; phone (303-468-5822), fax (303-262-0152).

For more information about the World Biodiversity Conservation Strategy and Action Plan please contact Kenton Miller or Walt Reid at the World Resources Institute, 1709 New York Avenue, Washington, D.C. USA 20006 phone (202-638-6300), fax (202-638-00360).

Seaweed Bandages

Seaweed, the ancient mariner's remedy for open wounds, is living up to its reputation. Emory University Ostomy Clinic in Atlanta, Georgia, is one of several U.S. hospitals studying the effects of seaweed bandages for open wounds. A seaweed wrap, processed until it resembles a soft cotton pad, is made of alginates from the cell walls of the seaweed. When the wrap comes in contact with saline drainage from a wound, it turns into a clean, moist gel that covers the wounded surface. The bandages are named "Sorbisan" and "Kaltostat" by competing manufacturers who claim the alginate can absorb 20 times its weight in wound drainage, including potentially harmful bacteria. It is said to not only keep wounds clean, but eases pain and speeds healing. [From *Ostomy Quarterly*, 1990, 27(4): 52.]

Bigger role for native people in British Columbia forestry

Native Indians have been shut out of the forest industry and they must be let in, a conference on native forestry heard May 17th, 1991. "Something has to change. Governments have to work with Indian communities to very dramatically and in a quick time frame provide for a highly skilled workforce," said Eric Denhoff, provincial deputy minister of native affairs. Land claims settlements may extend native jurisdiction over vast tracts of the province and provide increased opportunities in forest land management. Currently, natives control less than one half of one percent of the forest land base in B.C. Most timber land has been allocated to major forest product corporations, many internationally owned. Denhoff said the native role in forestry must be increased now, and that there must be a significant increase in the number of Indians hired. The Forest Resources Commission report says access to timber should be provided to the Indian community. Harry Derickson, president of the Intertribal Forestry Association of B.C., said that creative ideas will have to be developed to find a way to get Indian bands and companies participating in the forest economy. Richard Watts was critical of make-work federal projects that provide small licenses and two months work a year. His tribal council has developed a tree seedling nursery and sells its products to MacMillan Bloedel

and Fletcher Challenge. Creation of "aboriginal licenses" to allow native communities access to timber is one idea that should be considered, Watts said. And a "holistic" approach to the resource is required, taking into account Indian concerns about sustainability and respect for other forest values.

Spanish Edition of *Gene banks and the world's food*

A Spanish edition of the classic book, D.L. Plucknett, N. Smith, and J. William's 1987 *Gene banks and the world's food* will be published in the coming year by Princeton University Press. The book wil contain an introduction by Oscar Arias Sánchez, the former President of Costa Rica. The hardcover price of this 247 page book is listed as U.S. $35.00.

Illinois Natural History Survey Establishes *Center for Biodiversity*

The Illinois Natural History Survey has concerned itself with biota of the state since its formation in 1858. Recently the Survey was reorganized and its two principal study groups, one dealing with plants and the other with animals, were combined into a **Center for Biodiversity**. The mission of the new unit is to acquire and apply information pertaining to the diversity of life in order to protect, manage and develop the biotic resources of Illinois in accordance with long-term environmental goals. The center conducts biological surveys, studies of systematic relationships of organisms, and maintains and enhances the State's research collections of organisms and associated data bases. Last year the Survey sponsored a symposium in celebration of Earth Day 1990. The proceedings have now been published as *Our living heritage: The biological resources of Illinois*, divided into sessions on forests, prairies and barrens, wetlands, streams and caves, agro-urban ecology and appendices. Appendix 1 is of special interest; it reports the first (almost) complete survey of biota of any state (viruses were the only group omitted). The number of native species reported for the State is more than 53,000. The largest groups were insects (17,000) and fungi (20,000). There were 2,068 vascular plant and 649 vertebrate species. The aquatic fauna is rich with more than one quarter of all freshwater fishes and mussels of North America north of Mexico being found in Illinois.

How many species of fungi?

Fungi are important in many ecosystems as decomposers, soil developers and as conduits of soil nutrients to the roots of plants. David Hawksworth, eminent mycologist, computes that there may be many more species of fungi than previously thought. In the June 1991 issue of *Mycological Research*, using the ratio between species of fungi of vascular plans and species of fungi in the well-studied U.K. to the calculated world vascular plant species total of about 270,000 species, he arrives at an estimated number of 1.6 million species of fungi. There are about 69,000 species of fungi presently described. Robert M. May in *Nature* for August 8, 1991, suggests that this the 1.6 million figure may be too high because the scattered occurrence of tropical plants may lead to more generalized fungi, less specialized to individual plants. One could argue, however, that the geologically more stable tropics would have enhanced such specialization in comparison to boreal regions such as the U.K. impacted by glaciations. May also interprets the proportion of new fungal species, 15-30%, being described in the tropics as being too low to support Hawksworth's estimate. However, this supposes that biological surveys and taxonomic revisions uncover almost all the existing unnamed species; I suspect that May's assumption is rather unrealistic for a group like fungi where taxonomic funding is probably inadequate to sample adequately habitat-wise and geographically. D.E.M.

Human colon cancer gene discovered

The continued mapping of the human genome, finding locations and functions of the genes on human chromosones, can be expected to yield many benefits. The gene that, when mutated, results in formation of polyps (small finger-like projections) into the large intestine or colon that may become cancerous, has been discovered by two research teams. This discovery may lead to a more diagnostic test for those likely to develop this form of cancer, and might one day result in gene-splicing therapy to combat the disease. The inherited polyp disease, familial adenomatous polyposis, afflicts about 1 person out of 5,000 in the United States. [*Science News* 140: 86, August 10, 1991).

Caspian amphipod invades the Rhine

Pollutants and river warming from industrial, agricultural, mining, and domestic waste discharges has impoverished the native fauna of the river Rhine. A number of warm or more saline tolerant exotic species have invaded to fill the ecological niches vacated. A recent invader is the amphipod, *Corophium curvispinum*, originating in the Ponto-Caspian region. Explosions in the populations of this amphipod have resulted in densities of up to 100,000 specimens per square metre. It now covers about 200-500 km of the middle and lower Rhine. These large numbers mean that its filter-feeding may impact other filter feeders such as caddisfly larvae and the zebra mussel, as well as simple displacement of other species by occupying large surface areas of stones on the bottom and in breakwaters. An eye should be kept open for this species in North American basins, such as the Great Lakes-St. Lawrence, where it might be transported in ballast water. D.E.M. [*Nature* 352 (6336): 576].

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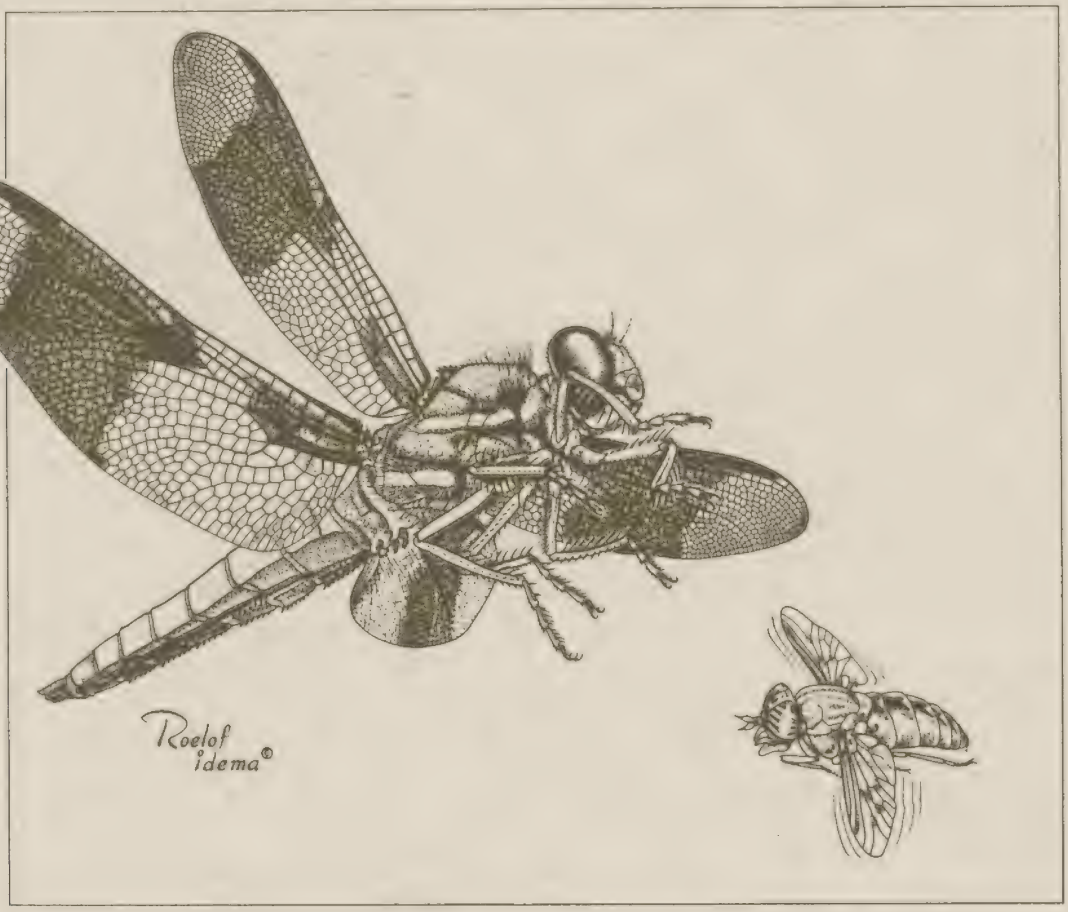

Biodiversity Meetings

■ September 1-6, 1991. **Symposium on International Biological Diversity and Global Change.** Sponsored at Amsterdam, Netherlands by the Union of Biological Sciences. Contact:

Dr. H.M. van Emdem
IUBS 24th General Assembly
c/o Biologische Road KNAW
P.O. Box 19121, 1000 GC
Amsterdam, The Netherlands
Telephone: 31-20-222902;
Fax: 31-20-204941

■ September 17-27, 1991. **10th World Forestry Congress: A heritage for the future, United Nations Food and Agriculture Organization (FAO).** To be held at Paris, France. Contact:
Mme Gueguen - Telephone: (33-1) 43-94-43-00; Fax: (33-1) 43-94-44-96.

■ September 30-October 5 - **EUCARPIA Symposium on Understanding Genetic Diversity from Vavilov to Molecular Genetics.** To be held at Leningrad (=St. Petersberg), U.S.S.R. Contact:
Dr. Sergey M. Alexanian
N.I. Vavilov All-Union Scientific
Research Institute of Plant Industry
44 Herzen Str., Leningrad, USSR.
Telephone: 314-48-48;
Fax: (812) 311-87-62.

■ October 4-6, 1991. **International Conference on Women and Biodiversity**, to be held at Harvard University's Kennedy School of Government, Cambridge, Massachussetts, U.S.A. International and rural women from centers of biological diversity will join academics, government representatives, NGO officials, and students to address issues, problems, and strategies for change "regarding the silent part women play in the conservation and use of biological diversity." Contact:
Brenda Coughlin
Committee on Women and Biodiversity
2 Laurel Street, Charlestown,
Massachussetts 02129, U.S.A.
Telephone: (617) 242-1763

Or Walt Reid
World Resources Institute
Telephone (202) 662-2534

■ October 6-12, 1991. **Third International Congress of Plant Molecular Biology**, held in Tucson, Arizona, U.S.A. Contact:
Woo Wester Conference Consultants
2934½ Beverly Glen Circle, Suite 383
Los Angeles, California 90077, U.S.A.
Fax: (213) 474-5894.

■ October 7-10, 1991. **Wildfor 91. Wildlife and Forestry: Towards a working relationship.** A National Forum: The forum is the first national attempt to bring together the major stakeholders in this field to talk constructively about ways to manage these natural resources. Arranged jointly by the Canadian Society of Environmental Biologists and the Canadian Pulp and Paper Association. Contact:
Wildfor Secretariat
Canadian Pulp and Paper Association
Woodlands Section, Sun Life Building,
19th Floor, 1155 Metcalfe Street,
Montréal, Québec H3B 4T6, Canada
Telephone: 514-866-6621;
Fax: 514-866-3035

■ October 12-16, 1991. **Designs for a global plant species information system,** to be held in Delphi, Greece. Contact:
G.F. Russell
Botany Department, NHB 166
Smithsonian Institution
Washington, D.C., 20560, U.S.A.

■ October 14-17, 1991. Second international conference on **Biotechnology of microbial products: Novel pharmacological and agrobiological activities** to be held in Sarasota, Florida, U.S.A. Contact:
A. Kulback
Society for Industrial Microbiology
P.O. Box 12534, Arlington, Virginia,
U.S.A. 22209-8534

■ October 22-24, 1991. Second annual **Human genome conference** will be held in San Diego,

California, U.S.A. Contact:
J.L. Teramani, AAAS
1333 H Street, N.W.
Washington, D.C. 20005, U.S.A.

■ November 4-8, 1991. **Global Assembly of Women and the Environment - Partners in Life.** Held by UNEP and World WIDE Network in Miami, Florida, U.S.A. Contact:
Joan Martin Brown, UNEP
1331 H Street, NW, Suite 903,
Washington, DC, U.S.A. 20005
Telephone: (202) 347-1514.

■ November 15-16, 1991. A conference on **Biotechnology and the environment: Managing risks** will be held in Montréal, Québec, Canada. Contact:
D. Pronovost, CREST
Université du Québec
P.O. Box 8888, Station A
Montréal, Québec, Canada

■ December 9-14, 1991. **Tropical Mountain Ecosystem Function.** This symposium, originally announced for July 1991, will be global in scope, highlight biodiversity and global change in America and Africa, and will be held at Papayán, Columbia. Information from A.M. Cleef, Correspondent for the Netherlands.

■ January/February 1992. **African NGOs Environment Network: NGO Preparatory Symposium on "African Environment - Towards sustainable management.** Venue to be announced. Contact:
ANEN, Tom M'Boya Street
P.O. Box 72421
Nairobi, Kenya
Telephone: (254-2) 747 960 or 740 817.

■ March 25-28, 1992. **Conference of the Society of Ethnobiology,** held in Washington, D.C., U.S.A. Contact:
Dr. Bruce Smith
Department of Anthropology
National Museum of Natural History,
Smithsonian Institution
Washington, D.C., U.S.A.
Telephone: (202) 357-1572.

■ June 1-12, 1992. ***The Earth Summit*, United Nations Conference on Environment and Development,** to be held in Rio de Janeiro, Brazil. The primary goal of the Summit will be to lay the foundation for a global partnership between developing and more industrialized countries, based on mutual need and common interests, to ensure the future of the planet. The Summit will be a conference of leaders of Government but its success will largely depend on the interest and support of peoples and their active participation in NGOs (non-governmental organizations) and citizens groups who will contribute to its preparations. Provision has been made for relevant NGOs to participate in meetings of the preparatory committee. A parallel event will be held by NGOs in Rio de Janeiro at the time of the Summit. Contact:
Secretariat,
United Nations Conference on
Environment and Development (UNCED)
Case postale 80, Conches
Switzerland
Telephone: 41-22-789-1676;
Fax: 41-22-789-3536

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NEWS FLASH!

Country Study of Costa Rican Biodiversity

Canadian and Costa Rican teams have just drafted a proposal plan of operations to carry out a UNEP Country Study. A Country Study is an inventory of a nation's biodiversity, an estimate of the costs of conserving biodiversity and the economic, social and environmental benefits.

The Canadian team was lead by Robert McFetridge, Canadian Museum of Nature, the Costa Rican Team by Gabriella M. de Niehaus, of the Ministry of External Relations and Culture. The plan will shortly be submitted for government approval.

Xerograph of a leaf of Canadian wild ginger, Asarum canadense; the leaves are 5 to 15 cm long. Wild ginger grows in moist, humus-rich soil with a pH of 5.5 to 6.5, under shady conditions. A perennial, it flowers in late spring, its solitary triangular flower brownish on a short stalk near the ground. Primarily self-pollinated, the seeds are dispersed by ants. The horizontal rhizome may be boiled until soft, then simmered in a sugar syrup for 30 minutes and eaten as candy. When dried the root can be substituted for commercial ginger; Indigenous peoples used it to spice their food. It can be propagated by planting sections of the rhizome about 1 cm deep, with the tip just above the surface. It grows in eastern woodlands from New Brunswick south to North Carolina and in the midwest from Manitoba to Missouri and Kansas. There are about 60 species in the genus Asarum.

Book and Periodical Niche

The Green List / La Liste Verte
A guide to Canadian environmental organizations and agencies. First edition. Canadian Environmental Network, P.O. Box 1289, Station B, Ottawa, Ontario K1P 5R3, Canada. 424 pp. ISBN 0-969-5217-0-7. Can$50 retail, $35 discount price for libraries, schools, and non-profit organizations.

The Environmental Revolution is now. New environmental organizations are appearing every day. How do you find groups with an interest in forests, international development, marine issues, etc.? How do you find their address, phone or fax number? What groups occur in your city, county or province? The answer is the newly published **Green List**, whether you are anglophone or francophone, as the list bilingual.

The introduction contains a foreword, describes Canadian Environmental Network (CEN, regional networks publications and services, gives messages from the sponsors, and tells how the directory was developed and can be used. The indices greatly enhance use of the directory; they are alphabetical by organization name, by environmental issues and topics (e.g., arctic and northern, international development, land use conflict, marine, etc.), descriptions of the organizations and agencies, plus update and order forms.

The following information is provided for most organizations: operating language; full name and acronym, address, phone and fax numbers, electronic mail system ID, contact persons, 3 priority issues and up to 8 additional issues (e.g., environmental education, health, pesticides), and type of organization (coalition/network, formal education institution, ENGO, government department/agency, industry association, labor organization, native organization, professional organization, non-ENGO NGOs, and research institution), year founded, number of staff and members, membership criteria, fees, description of nature of organization, its aims, main services or activities, scope (e.g., regional, international), newsletter name/frequency, services provided, and additional notes).

The mix of organizations is very good. The information recorded about organizations is useful. The layout and typography make it easy to pick out the organization and the particular information being sought. Alphabetical headers at the top of the page would help. Keeping up-to-date is the hardest task for a directory, CEN has done quite a good job. Checking through a series of recent business cards, almost every organization was included and every entry was correct, though the Yukon Fish and Wildlife Branch fax was omitted (403-667-3641). **Ocean Voice International** was listed under its old name, **International Marinelife Alliance Canada**. The phone numbers for **Canadian Museum of Nature** were out of date and my name was mispelled.

The Green List is $100 cheaper than the **Canadian Environmental Directory 1991** published by Canadian Almanac & Directory.

The CEN has performed a Trojan and environmentally friendly task in assembling this data. The CEN who produced the manuscript and Environment Canada, the Business Council on National Issues, Canadian Labor Congress, Canadian Petroleum Association and the Coal Association of Canada who supported its publication, are to be highly commmended. I've bought a copy for use at **Ocean Voice** and I'll have the **Canadian Museum of Nature** purchase a copy for daytime use at the museum. It's a green goldmine! D.E.M.

Biological Conservation Newsletter
Smithsonian Institution, Department of Botany, National Museum of Natural History, Washington, D.C., U.S.A.
The Smithsonian Institution is one of the world's great museums and a veritable treasurehouse of specimens and knowledge on biodiversity. Like many museums the Smithsonian is active in conservation issues. James A. Lovejoy, the museum's Assistant Secretary for External Affairs, is well-known for his research and educational conservation work on tropical rain forests. The Smithsonian's *Biological Conservation Newsletter* is also a well-known resource for conservationists. Its June 1991, 98th Number contains articles on **Ecotrust**, a new affiliate of **Conservation International** which will focus on conservation of coastal temperate rain forests of northwestern North America; a new **Center for World Environment**, established by a consortium of three major North Carolina universities; a review of educational materials on ancient forests produced by The Wilderness Society; and a (generous) review of *Canadian Biodiversity*. The final section of the newsletter is devoted to a listing of current literature on biological conservation. This listing contains 68 references to periodical articles or books, and is a most useful guide to the growing number of conservation titles. We recommend this newsletter to our conservation-oriented readers. The editor invites submission of information on biological conservation to: Jane Villa-Lobos, c/o Biological Conservation Newsletter, Smithsonian Institution, Department of Botany, NMB 166, Washington, D.C. 20560, U.S.A.

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On the brink: Endangered species in Canada
By J.A. Burnett, C.T. Dauphiné, Jr., S.H. McCrindle and T. Mosquin. Environment Canada, Ottawa. 192 pp. $29.95.

In taxodermic splendor at the Department of Biology at Queen's University reposes the only reported whooping crane from Ontario. As a member of that Department for two decades I suffered from its baleful stare with my colleagues. Perhaps this experience has made me receptive to the appearance of this valuable book on endangered species in Canada. The loss of species on our globe is a grim process that is deservedly receiving increasing public attention. (My younger son pleasantly surprised me by replying, when asked what he would like to receive as a Christmas gift, "some rain forest": he got it). This handsome volume is introduced as one of a series directed to environmental issues, and the several categories used by the Committee on the Status of Endangered Wildlife in Canada are outlined.

The bulk of the book is given to a presentation of the species accounts (vertebrates and plants) arranged by seven life zones that cover Canada. Care has obviously been exercised to see that the text is professional and suitably accompanied by range maps and photographs and/or paintings (which are fine examples of nature art). These accounts are unhappy variations on a Leitmotiv of human greed and exploitation. Perhaps the most sinister is the death of the Arctic peregrine falcons from pesticides accumulated in their "remote" habitat.

These accounts are sandwiched in between two essays. An opening essay sets the context: a dash of conservation ecology, prior extinctions in Canada over the last two centuries, and the central issue of values. The closing one focuses on recovery programs. A number of species have shown an encouraging response, although the list is short compared to that of endangered cases. The topic of costs of recovery and extinction could have been pursued more deeply, for here is the nub: how are we to evaluate the worth of species, and how much are we prepared to forego in order to enhance their survival? There is useful discussion of public involvement, with case studies.

Notwithstanding these essays, this work might have been strengthened by broadening its niche beyond that of a catalog. A more general orientation would have included explicit consideration of processes such as the origin of species (recalling the celebrated title of Darwin), hybridization, invasions, introductions, habitat selection, and natural versus anthropogenic extinctions. The disciplines of ecology, ethology, and evolutionary biology provide a necessary background for the comprehension of our present dilemma. Additionally, for those alert enough to be deeply concerned about extinctions, the tone is too meek. How is it that "the message of this book is intended to be one of optimism" when, for instance, the leaders of the G7 nations spend less than 15 minutes discussing the environment at their meeting in London in July, and the much-vaunted Canadian federal Green Plan remains political rhetoric?

Patrick Colgan
Canadian Museum of Nature

Tumivut
The cultural magazine of the Nunavik Inuit. 1991. Number 2. 64 pp. $5.00 per issue + GST + PST. Avataq Cultural Institute, Inukjuak, Québec, J0M 1M0, Telephone: (818) 254-8919 or 294 Carré St-Louis, Montréal, Québec H2X 9Z9, Canada, (514) 844-0109.

Tumivut is published twice a year by Avataq Cultural Institute, a native, non-profit organization mandated by Inuit Elders to protect and promote the language and culture of the Nunavik Inuit. Nunavik extends from the east coast of Hudson Bay (including Belcher Islands), through Hudson Strait and Ungava Bay to the northern tip of Labrador, including the coast and inland regions The magazine is beautifully printed on brown, matte, recycled paper. It is trilingual with Inuktitut syllabics, English and French versions of each article. Recent and historic photos, drawings and paintings, some in color, embellish the text.

This issue is devoted to Inuit games, but there are also columns on The Flora of Nunavik: Tea and fuel plants; Place names in Nunavik; an Archaeology Sections; and the Inuit Genealogy Project.

The column, **Flora of Nunavik**, will be of most interest to readers of *Canadian Biodiversity*. This column promotes Native and non-Native knowledge of plants, and celebrates the delicate beauty and diversity of plant life in Nunavik. This column is on tea and fuel plants. Five tea and fuel plants are treated in this issue, Northern Fireweed, Labrador Tea, Dwarf Birch, Arctic Cotton and Crowberry. The scientific, Inuktitut, French and English names are given for each species. Uses of each plant and its habitat are described. For example the fibre of Arctic cotton is used as wicks in soapstone oil lamps, to bandage cuts and the plant is used to cure impetigo. It is found on dry tundra, rocky hills and in humid tundra near lakes and rivers. Labrador tea leaves are used for tea and can also be chewed. The plant is good for colds, toothaches and dressing wounds. Each plant account is accompanied by a colored plant detail illustration and there are pleasing supplementary habitat photos. The reader is referred to Rousseau's *The vegetation of the Québec-Labrador Peninsula*; readers might also wish to refer to Scoggan's *The flora of Canada*, those in the western Arctic should read Porsild and Cody's *The vascular plants of continental Northwest Territories, Canada*; indeed many plants are common to eastern and western Arctic Canada.

The plant lore of Canada's aboriginal peoples is worthy of investigation by pharmaceutical and biotechnology companies. It is not only the First Peoples of tropical rainforests who have precious knowledge, developed over the centuries, about uses of native biodiversity.

I recommend this magazine for those interested in the North and in Arctic plants.

Don E. McAllister

Guide to the birds of Madagascar
By Olivier Langrad. 1990. Yale University Press, New Haven. 364 pp., 40 leaves of plates.

Fishes of the Great Barrier Reef and Coral Sea
Randall, John E. 1990. University of Hawaii Press, Honolulu. 507 pp, col. ill.

The Earth in transition: Patterns and processes of biotic impoverishment
1990. Cambridge University Press, New York.

Diversity, A news journal for the international plant genetic resources community.
A quarterly periodical of Genetic Resources Communications Systems, Inc., 727 8th Street, SE, Washington, D.C. 20003, U.S.A. Fax: (202) 544-2521. ISSN 0744-8163. Government/Non-profit institutions and individuals in North America $35, outside North America $50; all others in North America $55, outside North America $70. Volume 7, Numbers 1/2 of **Diversity** was a special double issue on Latin America released at the symposium **Genetic Diversity: Saving the World's Food Supply**.

Tropicus
Quarterly newsletter of Conservation International, 1015 18th Street, NW, Suite 1000, Washington, DC 20036, U.S.A. Telephone: (202) 429-5660.

A copy of the 8-page fall 1989 issue has come to hand and shows this newsletter should be of interest to those concerned with biodiversity. There are articles on the vanishing harpy eagle, found in Central and South American tropical rain-forests, ethnobotany and its contribution to medicine, and notes on Mexico's and Brazil's biological diversity and on Conservation International's report **The Debt-for-Nature Exchange: A Conservation Tool for Non-Profit Organizations**.

Tropicus is published quarterly for members and supporters of **Conservation International.** It is pleasingly designed, printed on cream paper with black and green inks. D.E.M.

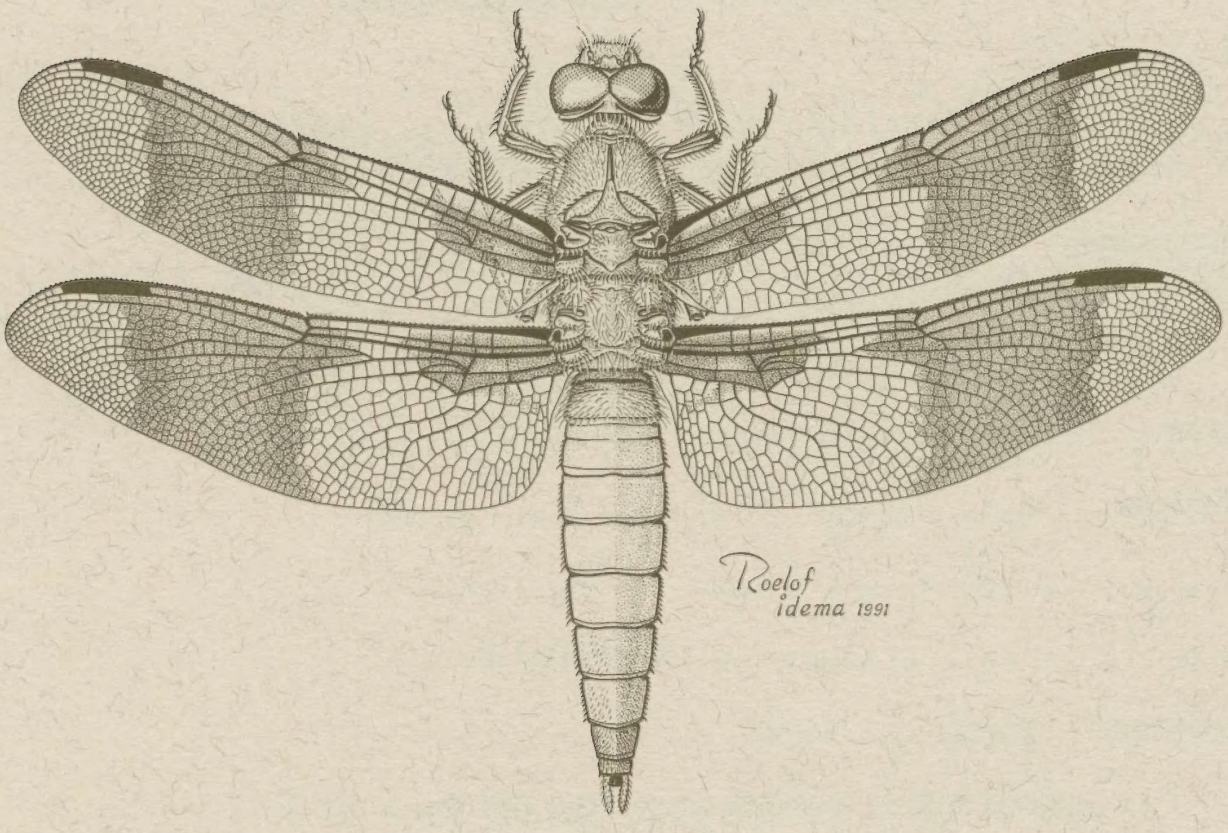

Illustration of *Libellula lydia*. This dragonfly is a member of the order Odonata, dragonflies and damselflies. Adults are often called darning needles or mosquito hawks because of their appearance and habits. Adults are aerial predators, actively feeding on other insects. The nymph is aquatic and, using its large and robust mouthparts, feeds voraciously on other aquatic insects, crustaceans and even very small fishes.

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I was born on this world,
my body is built of atoms
that have been part of it since it coalesced.

Michael Scott Rohan
1982, **Run to the stars.**

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